REPORT R-1605

EVALUATION OF M52A3B1 PRIMER WITH A MODIFIED PRIMING MIXTURE

By

F. LOMBARDI

OMS Code 4110.16.0077.1.00.53 (TS1-47)

DA Project 5S0405029

September 1961

REPORT R-1605

FRANKFORD ARSENAL
RESEARCH AND DEVELOPMENT GROUP
PHILADELPHIA 37, PA

REPORT R-1605

EVALUATION OF M52A3B1 PRIMER WITH A MODIFIED PRIMING MIXTURE

OMS Code 4110.16.0077.1.00.53 (TS1-47) DA Project 5S0405029

PREPARED BY: F. LOMBARDI
Physical Science Technician

REVIEWED BY: H. P. MANNING
Acting Chief
Ballistic Systems Division

APPROVED BY: C. C. FAWCETT
Acting Chief
Research and Development Group

FOR:
C. W. EIFLER
Colonel, Ordnance Corps
Commanding

FRANKFORD ARSENAL
Research and Development Group
Philadelphia 37, Pa.

September 1961

TABLE OF CONTENTS

ABSTRACT

Since the FAT27E1 electric primer (developed by Frankford Arsenal) and the Lake City experimental primer (a modified M52A3B1 primer) were developed for use with 20 mm aircraft ammunition, a test program was initiated to determine which would be best suited for general use where an electric primer having improved thermal output properties is required to insure adequate ignition of the propellant with minimum temperature coefficient.

The FAT27E1 primer produced a smaller change in pressure, velocity, and action time over the temperature range -70° to +165° F than either the Lake City experimental or the M52A3B1 primers with IMR 7005 and CR 7695 propellants. When used with the IMR 7005 propellant, the FAT27E1 primer produced excessive pressures at -70° F, probably due to grain breakage.

The Lake City experimental and the M52A3B1 primers performed equally well with all three propellants, but the Lake City experimental primer produced extreme amounts of flash and smoke at both breech and muzzle when fired in the M39A2 machine gun.

There is no significant advantage in performance with either the FAT27E1 or the Lake City experimental primer over the standard M52A3B1 primer when used with the WC 870 propellant.

EVALUATION OF M52A3B1 PRIMER WITH A MODIFIED PRIMING MIXTURE

INTRODUCTION

Cool burning, single base, extruded propellants were developed to improve barrel erosion characteristics of the single base, extruded type propellant.

During the development of the cool burning propellants, it became evident that an electric primer having improved thermal output properties was required to insure adequate ignition of the propellant with minimum temperature coefficient. Air Force MIPR 42-600-8-1305-6333, Project Order No. 88428333-07-61201 authorized the development of such a primer - ".....furnish primer compatible with improved propellants, both low erosion, extruded, single base, and other low temperature coefficient, and supply and test 5000 rounds containing such primers."

The FAT27E1 electric primer was successfully developed for improved ignition of cool burning, single base, extruded propellants. Frankford Arsenal Reports R-1479 and R-1479A cover the technical aspects of the development of this electric primer.

Lake City Arsenal initiated a program to develop an improved M52A3B1 primer with respect to eliminating the hangfire tendency obtained with 20 mm aircraft ammunition using principally double base, ball propellant.

Since the two primer developments were for 20 mm aircraft ammunition, a test program was initiated to determine which primer would be the best suited for general use. The results of this program are reported herein.

OBJECT

To determine, by various ballistic tests, whether the Lake City Arsenal experimental electric primer developed for WC 870 ball propellant or the Frankford Arsenal electric primer developed for cool burning, extruded, single base propellant is the better primer for use in 20 mm aircraft ammunition with propellants IMR 7005, WC 870 and CR 7695.

METHOD AND PROCEDURE

Charges were established for the three propellants IMR 7005, WC 870, and CR 7695 with the three primers, Lake City experimental, Frankford Arsenal experimental and the M52A3B1, using a 3-point slope.

A 10-round series was fired at +70° F for uniformity and verification, using the selected propellant charge.

Ballistic tests were conducted at cold, normal, and hot temperatures, with all rounds being conditioned for 4 hours before firing. A separate test barrel was used for each propellant, each barrel having the minimum number of rounds fired for break-in. This was done to eliminate the effect of propellant interaction.

A 20-round series at each temperature (+70°, -70° and +165° F) was fired in a gage (pressure barrel). These rounds were conditioned for 4 hours.

Ten-round groups of each lot were fired at +70°, -70°, and +165° F for pressure-time relationships. As before, a separate test barrel was used for all the lots loaded with the same propellant. These rounds were conditioned for 2 hours.

The 20 mm M103 case, primed with the M52A3B1 primer, was used for control.

A continuous burst of 125 rounds for each test lot was fired in the M39A2 machine gun for function and casualty at +70°, -70°, and +165° F. Flash, weapon function, ammunition function, and cyclic rate (rounds per minute) were recorded.

RESULTS

Charges established for the three propellants were: IMR 7005, 570 grains; WC 870, 600 grains; CR 7695, 550 grains. The same propellant charge was used with all three primers. The propellant charge establishment was conducted with all rounds being hand loaded; in the verification firing and remaining ballistic tests, all rounds were machine loaded.

Table I and the discussions which follow are based on a 20-round series at each temperature, +70°, -70°, and +165° F, as fired in a gage (pressure barrel).

Table I. CHANGE IN AVERAGE VELOCITY
(As Recorded at 78 Ft)

Propellant	Primer	Change in Average Velocity (fps) -70° to +70° F	Change in Average Velocity (fps) +70° to +165° F
IMR 7005, AL 41313	FAT27E1	+29	+14
	LC experimental	+136	-17
	M52A3B1	+80	+77
CR 7695-2	FAT27E1	+26	+10
	LC experimental	+88	+28
	M52A3B1	+137	+13
WC 870, AL 42712	FAT27E1	+171	+96
	LC experimental	+155	+105
	M52A3B1	+191	+115

With the exception of the cartridges charged with WC 870 propellant and using any of the primers, the ballistic data showed significantly smaller changes in velocity over the temperature range -70° to +165° F with cartridges primed with the FAT27E1 primer.

Velocity-temperature coefficients are listed in Appendix A, Table A-6.

Note: All velocities in this report are corrected velocities. Reference round data follows.

Authorization:	DEM 103-56
Case lot:	427
Bullet lot:	438
Propellant:	41367
Charge:	618 grains
Velocity:	3365 f/s

The significant change in average pressure over the temperature range -70° to +165° F is that the pressure increases as temperature decreases when using the FAT27E1 primer with propellants IMR 7005 and CR 7695.

The FAT27E1 primer, when used with the IMR 7005 propellant, produced individual maximum pressures of 74.0 Kpsi when fired at -70° F. Because of this no further temperature firing was conducted with this propellant-primer combination.

Unlike the ballistic data obtained with the IMR 7005 and CR 7695 propellants, the WC 870 propellant produced a drop in pressure at -70° F with both the FAT27E1 and the Lake City experimental primers (see Table II).

Table II. CHANGE IN AVERAGE PRESSURE (Copper)

Propellant	Primer	Change in Average Pressure (psi) +70° to -70° F	Change in Average Pressure (psi) +70° to +165° F
IMR 7005, AL 41313	FAT27E1	+9100	-2700
	LC experimental	-3600	-4100
	M52A3B1	+400	+2900
CR 7695-2	FAT27E1	+2400	-1000
	LC experimental	-6200	+800
	M52A3B1	-10600	-400
WC 870, AL 42712	FAT27E1	-7500	+10000
	LC experimental	-7900	+9500
	M52A3B1	-9300	+10500

Since the temperature coefficients were not generally constant over the total temperature range considered, they are listed for the temperature intervals as shown in Appendix A, Table A-6.

The FAT27E1 primer produced less of a change in action time than the Lake City experimental primer over the temperature range -70° to +165° F when used with propellants IMR 7005 and CR 7695. Very little change in action time was noticed between the FAT27E1 and the Lake City experimental primer when used with the WC 870 propellant. (See Table III.)

Table III. CHANGE IN AVERAGE ACTION TIME

Propellant	Primer	Change in Average Action Time (ms) -70° to +165° F
IMR 7005 AL 41313	FAT27E1	0.09
	LC experimental	0.14
	M52A3B1	0.27

Table III. CHANGE IN AVERAGE ACTION TIME (Cont'd)

Propellant	Primer	Change in Average Action Time (ms) -70° F to +165° F
CR 7695-2	FAT27E1	0.09
	LC experimental	0.40
	M52A3B1	0.55
WC 870, AL 42712	FAT27E1	0.28
	LC experimental	0.27
	M52A3B1	0.38

FUNCTION AND CASUALTY

A 125-round burst was fired in the M39A2 weapon for function and casualty with each propellant-primer combination. No machine gun firings were conducted with the IMR 7005 and FAT27E1 propellant-primer combination at -70° or +165° F.

One stoppage occurred at +70° F with the CR 7695/FAT27E1 propellant-primer combination because of a cocked primer, and one stoppage with the CR 7695/M52A3B1 propellant-primer combination because of a broken firing circuit. One small primer leak occurred with the Lake City experimental primer when fired at -70° F. Otherwise there were no serious weapon stoppages or other detrimental effects to the weapon-ammunition system in the tests fired.

The cyclic rate as fired in the M39A2 machine gun is considerably lower with the FAT27E1 primer at normal temperatures, particularly when used with the CR 7695 propellant.

Photographs of the cumulative flash produced by 125 round bursts at various temperatures indicate that the Lake City experimental primer produces excessive muzzle and breech flame and spark activity over the entire temperature range, -70° to +165° F.

See Appendix C for photographs of cumulative flash which was recorded using a remote-controlled 4 x 5 Grafflex Camera to show the cumulative flash produced by a 125-round burst.

CONCLUSIONS

1. The FAT27E1 primer produced a smaller change in pressure, velocity, and action time over the temperature range -70° to +165° F than either the Lake City experimental or the M52A3B1 primers with IMR 7005 and CR 7695 propellants. The FAT27E1 primer when used with the IMR 7005 propellant produced excessive pressures at -70° F (probably due to grain breakage).

2. The Lake City experimental and the M52A3B1 primers performed equally as well with all three propellants, with the exception that the Lake City experimental primer produced extreme amounts of flash and smoke at both breech and muzzle when fired in the M39A2 machine gun.

3. There is no significant advantage in performance with either the FAT27E1 or the Lake City experimental primer over the standard M52A3B1 primer when used with the WC 870 propellant.

RECOMMENDATIONS

It is recommended that

1. The FAT27E1 primer be used with propellant CR 7695 in 20 mm aircraft ammunition.

2. The M52A3B1 primer be used with propellants IMR 7005 and WC 870 in 20 mm aircraft ammunition.

3. A lower pellet weight be determined for the FAT27E1 primer to obtain desirable cartridge pressure characteristics with propellant IMR 7005 while retaining the improved temperature coefficient associated with this primer.

4. Since the FAT27E1 primer offers significantly improved temperature coefficients of velocity, pressure, and action time, and the primer was developed for and tested in the M39A2 machine gun, a qualification test be made for the FAT27E1 primer in the M61 machine gun.

APPENDIX A

RESULTS OF FIRING AT FRANKFORD ARSENAL

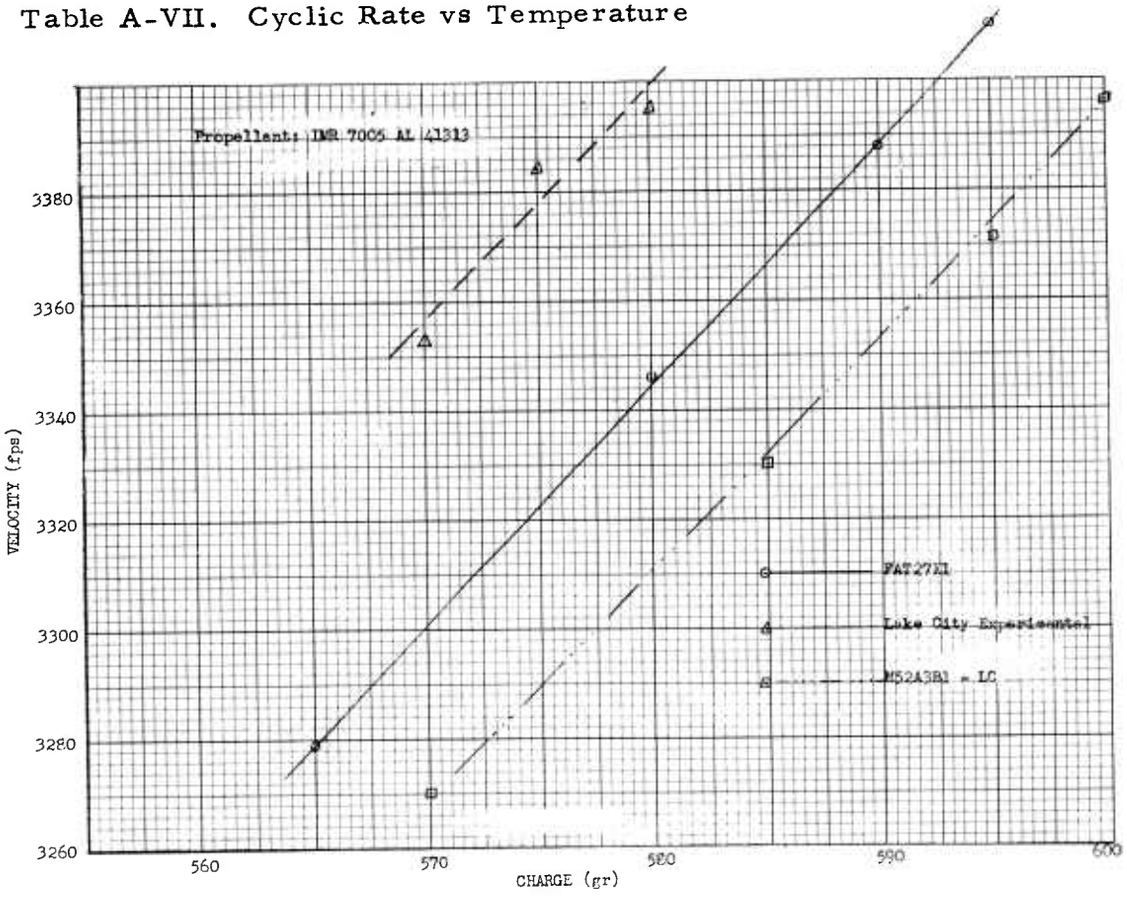


Figure A-1. Graph showing Method of Interpretation of Time Relations

Table A-I. CHARGE ESTABLISHMENT

Ballistic relationships of experimental primers with IMR 7005, WC 870, and CR 7695 propellants at normal (+70° F) temperature

Primer	Propellant Type	Charge (gr)	No. of Rounds	Velocity (fps) Corrected	Ext Var	Std Dev	Pressure (psi) Corrected	Ext Var	Std Dev	Action Time (ms)
FAT27E1	CR 7695-2	540	5	3330	41		57,200	7200		2.72
		545	10	3324	15		54,800	3900	1300	2.67
		550	5	3366	38		58,900	6500		2.57
		555	10	3362	27	*	57,600	4900	1400	2.56
		560	5	3378	49	*	59,100	3500		2.60
LC experimental	CR 7695-2	400	2	2795	40		39,000	5000		2.83
		550	10	3351	45	16	57,100	5300	1700	2.42
		550	5	3366	48	17	57,000	5000	2000	2.56
		555	10	3373	45	15	59,100	5800	2000	2.45
		570	2	3438	7		61,200	1100		2.60
M52A3B1	CR 7695-2	530	5	3279	25	10	53,000	700	300	
		545	5	3336	15	6	55,700	4400	1500	*
		550	10	3349	36	10	57,100	4500	1600	*
		560	5	3402	24	9	60,000	1500	600	
FAT27E1	WC 870, AL 42712	580	5	3312	18	7	51,200	1700	700	2.56
		595	5	3366	15	6	54,300	2900	1000	2.47
		600	10	3373	29	8	53,800	2700	900	2.45
		610	5	3417	22	9	55,600	2700	1000	2.44
LC experimental	WC 870, AL 42712	590	5	3361	12	5	52,700	2900	900	2.47
		595	5	3367	18	7	51,200	3100	1200	2.48
		600	5	3384	5	2	52,000	1100	500	2.46
		600	10	3363	38	9	50,600	3900	1100	2.47
		605	10	3397	20	7	53,100	2600	800	2.44
M52A3B1	WC 870 AL 42712	580	5	3275	14	5	46,700	2800	1000	
		595	5	3331	24	8	50,000	3300	1100	
		610	5	3387	10	5	51,200	3200	1200	*
		610	10	3382	29	10	52,000	2900	900	
FAT27E1	IMR 7005, AL 41313	565	5	3279	22	8	49,100	1100	400	
		580	5	3346	18	6	52,200	3200	1100	
		590	10	3388	32	11	54,700	4400	1300	*
		595	5	3410	19	8	55,600	3700	1500	
LC experimental	IMR 7005, AL 41313	570	5	3353	16	7	50,600	4400	1500	2.49
		575	5	3384	7	3	53,700	1300	500	2.44
		580	5	3395	15	6	53,400	3200	1000	2.47
		593	2	3450	7		56,700	600		2.45
M52A3B1	IMR 7005, AL 41313	570	5	3270	27	9	46,600	3600	1300	
		585	5	3330	18	7	58,600	2800	1100	
		595	10	3371	25	9	50,200	2600	900	*
		600	5	3396	19	7	51,000	1300	400	

*Not recorded.

Table A-II. CHARGE VERIFICATION

Ballistic relationships of experimental primers with IMR 7005, WC 870, and CR 7695 propellant at normal (+70° F) temperature

Primer	Propellant Type	Propellant Charge (gr)	No. of Rounds	Velocity (fps) Corrected	Velocity (fps) Ext Var	Velocity (fps) Std Dev	Pressure (psi) Corrected	Pressure (psi) Ext Var	Pressure (psi) Std Dev	Action Time (ms)
FAT27E1	CR 7695-2	545	10	3330	23	9	57,200	4300	1200	2.54
		555	10	3357	26	7	58,100	3800	900	2.56
		555	10	3366	22	7	60,200	4000	1000	2.45
LC experimental	CR 7695-2	540	10	3293	24	7	54,500	3500	1000	2.68
		550	10	3339	32	10	56,700	5500	1600	2.64
		555	10	3354	29	9	57,700	4000	1300	2.61
M52A3B1	CR 7695-2	540	10	3303	27	7	55,100	3400	1100	2.76
		550	10	3342	26	8	57,700	5400	1300	2.73
		555	10	3369	22	6	59,100	3100	900	2.70
FAT27E1	WC 870, AL 42712	590	10	3354	16	5	53,000	1800	600	2.52
		600	10	3387	20	5	54,500	3800	1300	2.48
LC experimental	WC 870, Al 42712	590	10	3340	15	4	52,100	1900	700	2.51
		600	10	3376	15	4	54,200	2600	700	2.48
M52A3B1	WC 870, AL 42712	600	10	3363	32	8	52,800	3600	1100	2.53
		605	10	3410	18	6	54,900	2800	900	2.51
		610	10	3399	10	3	54,000	3100	800	2.49
FAT27E1	IMR 7005, AL 41313	565	10	3377	40	11	57,400	5700	1700	2.45
		570	10	3400	44	11	55,100	6600	1600	2.51
LC experimental	IMR 7005, AL 41313	570	10	3367	25	9	51,300	2000	700	2.57
M52A3B1	IMR 7005, AL 41313	570	10	3362	27	9	51,500	3900	1200	2.68

Table A-III. TEMPERATURE FIRINGS

Ballistic relationships of experimental primers with IMR 7005, WC 870, and CR 7695 propellants at normal (+70° F), hot (+165° F), and cold (-70° F) temperatures. Recorded simultaneously as fired in a gage (pressure barrel). 20 rounds.

Primer	Temperature (°F)		Velocity (fps)			Pressure (psi)				Action Time (ms)		
	Storage	Firing	Average	Ext Var	Std Dev	Average	Ext Var	Std Dev	Max Individual	Average	Ext Var	Max Ind
IMR 7005, AL 41313												
LC experimental	+70	+70	3388	21	5	53,900	3,000	900	55,300	2.46	0.05	2.49
	+165	+165	3371	43	12	49,800	4,400	1,100	52,000	2.64	0.16	2.74
	-70	-70	3252	123	22	50,300	8,400	1,600	52,000	2.78	0.26	2.96
M52A3B1	+70	+70	3301	34	9	46,700	4,500	1,200	49,600	2.71	0.11	2.77
	+165	+165	3378	50	12	49,600	6,300	1,500	52,800	2.69	0.14	2.74
	-70	-70	3221	57	14	47,100	5,100	1,200	49,300	2.96	0.14	3.04
FAT27E1	+70	+70	3355	35	9	52,900	7,400	1,800	54,200	2.53	0.11	2.58
	+165	+165	3369	28	8	50,200	6,100	1,800	52,200	2.63	0.12	2.67
	-70	-70	3326	136	34	62,000	23,100	5,400	75,600	2.54	0.34	2.69
CR 7695-2												
LC experimental	+70	+70	3370	51	12	58,500	7,500	1,800	61,200	2.63	0.06	2.66
	+165	+165	3398	85	17	59,300	10,900	2,600	65,300	2.58	0.14	2.66
	-70	-70	3282	72	20	52,300	10,400	2,700	58,000	2.98	0.34	3.11
M52A3B1	+70	+70	3385	34	9	59,000	5,500	1,500	60,300	2.77	0.13	2.84
	+165	+165	3398	41	10	58,600	8,600	2,100	62,800	2.67	0.10	2.73
	-70	-70	3248	51	14	48,400	3,800	1,000	48,800	3.22	0.21	3.33
FAT27E1	+70	+70	3374	93	21	59,400	7,800	2,300	64,300	2.57	0.28	2.70
	+165	+165	3384	77	20	58,400	8,700	1,900	63,400	2.59	0.15	2.66
	-70	-70	3348	59	15	61,800	9,300	2,400	64,600	2.68	0.22	2.80
WC 870, AL 42712												
LC experimental	+70	+70	3379	32	8	53,300	5,000	1,100	54,800	2.50	0.07	2.53
	+165	+165	3484	29	6	62,800	6,400	1,700	63,200	2.41	0.07	2.46
	-70	-70	3224	85	24	45,400	6,900	1,800	47,500	2.68	0.17	2.79
M52A3B1	+70	+70	3368	42	9	52,300	6,000	1,700	52,600	2.54	0.10	2.58
	+165	+165	3483	32	8	62,800	6,700	1,700	63,700	2.46	0.11	2.53
	-70	-70	3177	96	26	43,000	6,400	1,700	43,900	2.84	0.21	2.91
FAT27E1	+70	+70	3384	41	9	53,800	6,000	1,400	54,100	2.47	0.14	2.55
	+165	+165	3480	40	12	63,800	3,300	700	63,000	2.41	0.11	2.47
	-70	-70	3213	66	18	46,300	5,300	1,400	46,400	2.69	0.42	3.02

Table A-IV. PRESSURE-TIME DATA

Results of ballistic tests of experimental primers and IMR 7005, WC 870, and CR 7695 propellants at normal (+70° F), hot (+165° F), and cold (-70° F) temperatures, as recorded with a piezoelectric gage.

Primer	Temperature (°F)		Velocity (fps)			Pressure (psi)				Action Time (ms)
	Storage	Firing	Average	Ext Var	Std Dev	Average	Maximum	Ext Var	Std Dev	
				IMR 7005, AL 41313 (570 gr)						
LC experimental	+70	+70	3358	98	38	59,100	62,600	7,500	2900	2.53
	-70	-70	3234	229	62	51,100	55,600	10,800	3400	2.66
	+165	+165	3473	37	10	69,200	75,100	8,100	2200	2.41
M52A3B1	+70	+70	3302	42	12	55,600	56,800	4,100	1200	2.69
	-70	-70	3225	102	33	53,500	56,800	7,200	2400	2.97
	+165	+165	3370	30	10	57,800	59,000	2,600	700	2.73
FAT27E1	*									
				CR 7695-2 (550 gr)						
LC experimental	+70	+70	3391	67	21	67,700	71,400	8,000	2600	2.63
	-70	-70	3278	124	41	57,100	62,400	13,000	4600	2.93
	+165	+165	3389	30	8	67,500	71,000	6,400	1800	2.58
M52A3B1	+70	+70	3377	38	10	62,500	69,700	5,500	1865	2.75
	-70	-70	3249	72	18	53,800	57,100	6,000	1900	3.18
	+165	+165	3397	92	25	65,600	69,300	9,300	2800	2.67
FAT27E1	+70	+70	3351	64	19	67,700	72,300	7,900	2400	2.64
	-70	-70	3380	45	14	67,100	72,100	7,400	2100	2.49
	+165	+165	3386	43	14	66,100	67,100	2,900	900	2.53
				WC 870, AL 42712 (600 gr)						
LC experimental	+70	+70	3305	29	7	54,400	56,100	3,100	900	2.65
	-70	-70	3237	101	29	55,200	58,000	8,800	2500	2.79
	+165	+165	3350	30	9	56,900	58,400	3,200	900	2.65
M52A3B1	+70	+70	3387	38	10	60,000	61,400	2,500	900	2.51
	-70	-70	3269	115	30	53,600	57,700	6,300	1500	2.66
	+165	+165	3485	25	8	69,000	71,000	3,300	1000	2.44
FAT27E1	+70	+70	3391	17	5	62,500	63,600	2,500	900	2.46
	-70	-70	3230	34	11	51,100	52,200	2,800	1000	2.65
	+165	+165	3491	31	10	69,300	71,200	4,500	1400	2.41

*Because of high pressures encountered in gage, firing on this lot was discontinued.

Table A-V. IGNITION-TIME DATA

Results of ballistic test of experimental primers and IMR 7005, WC 870, and CR 7695 propellants at normal (+70° F), hot (+165° F), and cold (-70° F) temperatures, as recorded with a piezoelectric gage.

Primer	Temp (°F)	Primer Ignition Time (ms)			Powder Ignition Time (ms)			Action Time (ms)			
		Average	Ext Var	Std Dev	Average	Ext Var	Std Dev	Average	Maximum	Ext Var	Std Dev
					IMR 7005, AL 41313						
LC experimental	+70	0.31	0.05	0.02	0.18	0.11	0.04	2.53	2.64	**0.19**	**0.08**
	-70	0.27	0.08	0.02	0.20	0.10	0.03	2.66	2.81	**0.22**	**0.07**
	+165	0.29	0.14	0.04	0.12	0.10	0.03	2.41	2.43	**0.04**	**0.01**
M52A3B1	+70	0.33	0.05	0.02	0.27	0.04	0.01	2.69	2.74	**0.15**	**0.05**
	-70	0.33	0.12	0.03	0.43	0.15	0.05	2.97	3.06	**0.20**	**0.07**
	+165	0.33	0.06	0.02	0.28	0.08	0.03	2.73	2.81	**0.13**	**0.04**
FAT27E1*											
					CR 7695-2						
LC experimental	+70	0.32	0.06	0.02	0.29	0.11	0.03	2.63	2.66	**0.07**	**0.03**
	-70	0.34	0.08	0.02	0.46	0.23	0.07	2.93	3.10	**0.27**	**0.09**
	+165	0.33	0.05	0.02	0.23	0.07	0.02	2.58	2.63	**0.14**	**0.04**
M52A3B1	+70	0.36	0.15	0.04	0.37	0.13	0.04	2.75	2.81	**0.12**	**0.04**
	-70	0.36	0.07	0.02	0.67	0.22	0.06	3.18	3.35	**0.35**	**0.10**
	+165	0.35	0.10	0.04	0.31	0.23	0.07	2.67	2.74	**0.34**	**0.10**
FAT27E1	+70	0.32	0.07	0.02	0.32	0.13	0.04	2.64	2.75	**0.24**	**0.09**
	-70	0.30	0.10	0.03	0.20	0.06	0.02	2.49	2.59	**0.18**	**0.05**
	+165	0.32	0.04	0.01	0.20	0.09	0.03	2.53	2.58	**0.11**	**0.03**
					WC 870, AL 42712						
LC experimental	+70	0.31	0.07	0.02	0.17	0.16	0.05	2.65	2.73	**0.12**	**0.04**
	-70	0.35	0.05	0.02	0.34	0.16	0.06	2.79	2.86	**0.11**	**0.03**
	+165	0.31	0.04	0.01	0.19	0.09	0.02	2.65	2.68	**0.06**	**0.02**
M52A3B1	+70	0.33	0.12	0.04	0.08	0.08	0.03	2.51	2.53	**0.04**	**0.01**
	-70	0.29	0.04	0.02	0.22	0.05	0.02	2.66	2.75	**0.13**	**0.04**
	+165	0.22	0.04	0.01	0.19	0.05	0.02	2.44	2.47	**0.06**	**0.02**
FAT27E1	+70	0.30	0.07	0.02	0.09	0.04	0.01	2.46	2.50	**0.06**	**0.02**
	-70	0.31	0.12	0.03	0.14	0.05	0.02	2.65	2.76	**0.17**	**0.05**
	+165	0.30	0.09	0.02	0.12	0.06	0.02	2.41	2.48	**0.14**	**0.04**

*No pressure-time firing conducted with this lot.

Table A-VI. TEMPERATURE COEFFICIENTS

Ballistic relationships of experimental primers with IMR 7005, WC 870, and CR 7695 propellants at normal (+70° F), hot (+165° F), and cold (-70° F) temperatures. Recorded simultaneously as fired in a gage (pressure barrel).

Primer	Temp (°F)	Pressure (psi) Average	Pressure (psi) Change	Press-Temp Coefficient (psi/°F)	Velocity (fps) Average	Velocity (fps) Change	Vel-Temp Coefficient (fps/°F)	Action Time (ms) Average	Action Time (ms) Change	AT-Temp Coefficient (ms/°F)
					IMR 7005, AL 41313					
FAT27E1	-70	62,000			3326			2.54		
			+9,100	65.0		-29	0.21		+0.01	0.00007
	+70	52,900			3355			2.53		
			-2,700	28.4		+14	0.15		+0.10	0.0010
	+165	50,200			3369			2.63		
LC experimental	-70	50,300			3252			2.78		
			-3,600	25.7		-136	0.97		+0.32	0.0023
	+70	53,900			3388			2.46		
			-4,100	43.1		-17	0.18		+0.22	0.0016
	+165	49,800			3371			2.64		
M52A3B1	-70	47,100			3221			2.96		
			+400	2.9		-80	0.57		+0.25	0.0018
	+70	46,700			3301			2.71		
			+2,900	30.5		+77	0.81		-0.02	0.0002
	+165	49,600			3378			2.69		
					CR 7695-2					
FAT27E1	-70	61,800			3348			2.68		
			+2,400	17.1		-26	0.19		+0.11	0.0008
	+70	59,400			3374			2.57		
			-1,000	10.5		+10	0.11		+0.02	0.0002
	+165	58,400			3384			2.59		
LC experimental	-70	52,300			3282			2.98		
			-6,200	44.3		-88	0.63		+0.35	0.0025
	+70	58,500			3370			2.63		
			+800	8.4		+28	0.29		-0.05	0.0005
	+165	59,300			3398			2.58		
M52A3B1	-70	48,400			3248			3.22		
			-10,600	75.7		-137	0.98		+0.45	0.0032
	+70	59,000			3385			2.77		
			-400	4.2		+13	0.14		-0.10	0.0010
	+165	58,600			3398			2.67		
					WC 870, AL 42712					
FAT27E1	-70	46,300			3213			2.69		
			-7,500	53.6		-171	1.22		+0.22	0.0016
	+70	53,800			3384			2.47		
			+10,000	105.2		+96	1.01		-0.06	0.0006
	+165	63,800			3480			2.41		
LC experimental	-70	45,400			3224			2.68		
			-7,900	56.4		-155	1.11		+0.18	0.0013
	+70	53,300			3379			2.50		
			+9,500	100.0		+105	1.11		-0.09	0.0009
	+165	62,800			3484			2.41		
M52A3B1	-70	43,000			3177			2.84		
			-9,300	66.4		-191	1.36		+0.30	0.0021
	+70	52,300			3368			2.54		
			+10,500	110.5		+115	1.21		-0.08	0.0008
	+165	62,800			3483			2.46		

Table A-VII. CYCLIC RATE VS TEMPERATURE

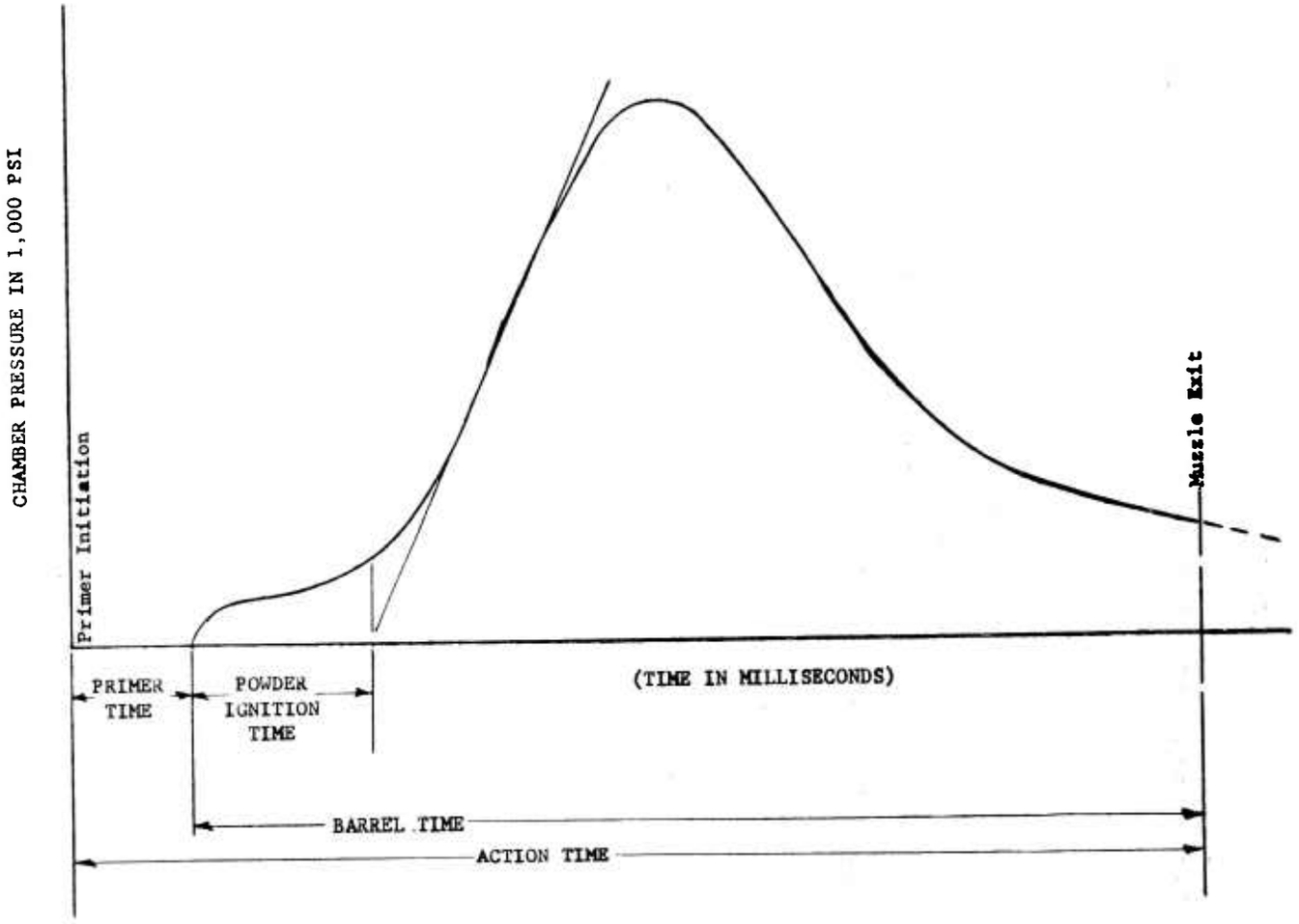
Results of ballistic tests of experimental primers and IMR 7005, WC 870, and CR 7695 propellant at normal (+70° F), hot (+165° F), and cold (-70° F) temperatures, as fired in the M39A3 machine gun.

Primer	Temp (°F)	Rounds/Minute
	IMR 7005, AL 41313	
FAT27E1	+70	1469
	-70	-
	+165	-
LC experimental	+70	1565
	-70	1525
	+165	1545
M52A3B1	+70	1512
	-70	1551
	+165	1518
	CR 7695-2	
FAT27E1	+70	1300
	-70	1353
	+165	1385
LC experimental	+70	1512
	-70	1418
	+165	1417
M52A3B1	+70	1493
	-70	1395
	+165	1401
	WC 870, AL 42712	
FAT27E1	+70	1406
	-70	1621
	+165	1551
LC experimental	+70	1578
	-70	1607
	+165	1643
M52A3B1	+70	1518
	-70	1538
	+165	1545

APPENDIX B

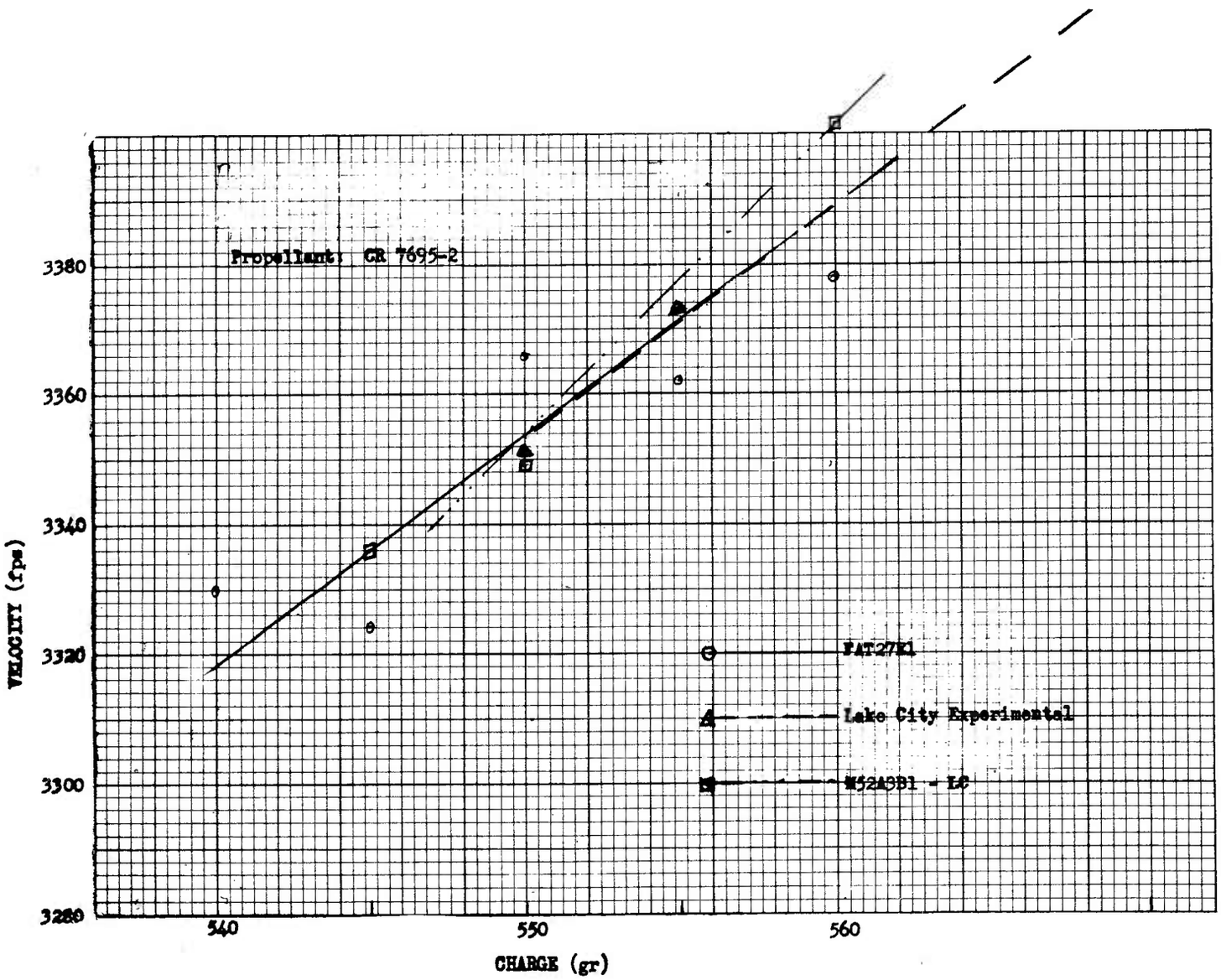
GRAPHS OF RESULTS OF FIRINGS AT FRANKFORD ARSENAL

Graphs B-1, B-2, B-3	-	Velocity vs Charge
Graphs B-4, B-5, B-6	-	Pressure vs Charge
Graphs B-7, B-8, B-9	-	Pressure vs Temperature (20-round group, fired in a gage)
Graphs B-10, B-11, B-12	-	Velocity vs Temperature (20-round group, fired in a gage)
Graphs B-13, B-14, B-15	-	Action Time vs Temperature (20-round group, fired in a gage)
Graphs B-16, B-17, B-18	-	Cyclic Rate vs Temperature (125-round burst, fired in the M39A2 machine gun)

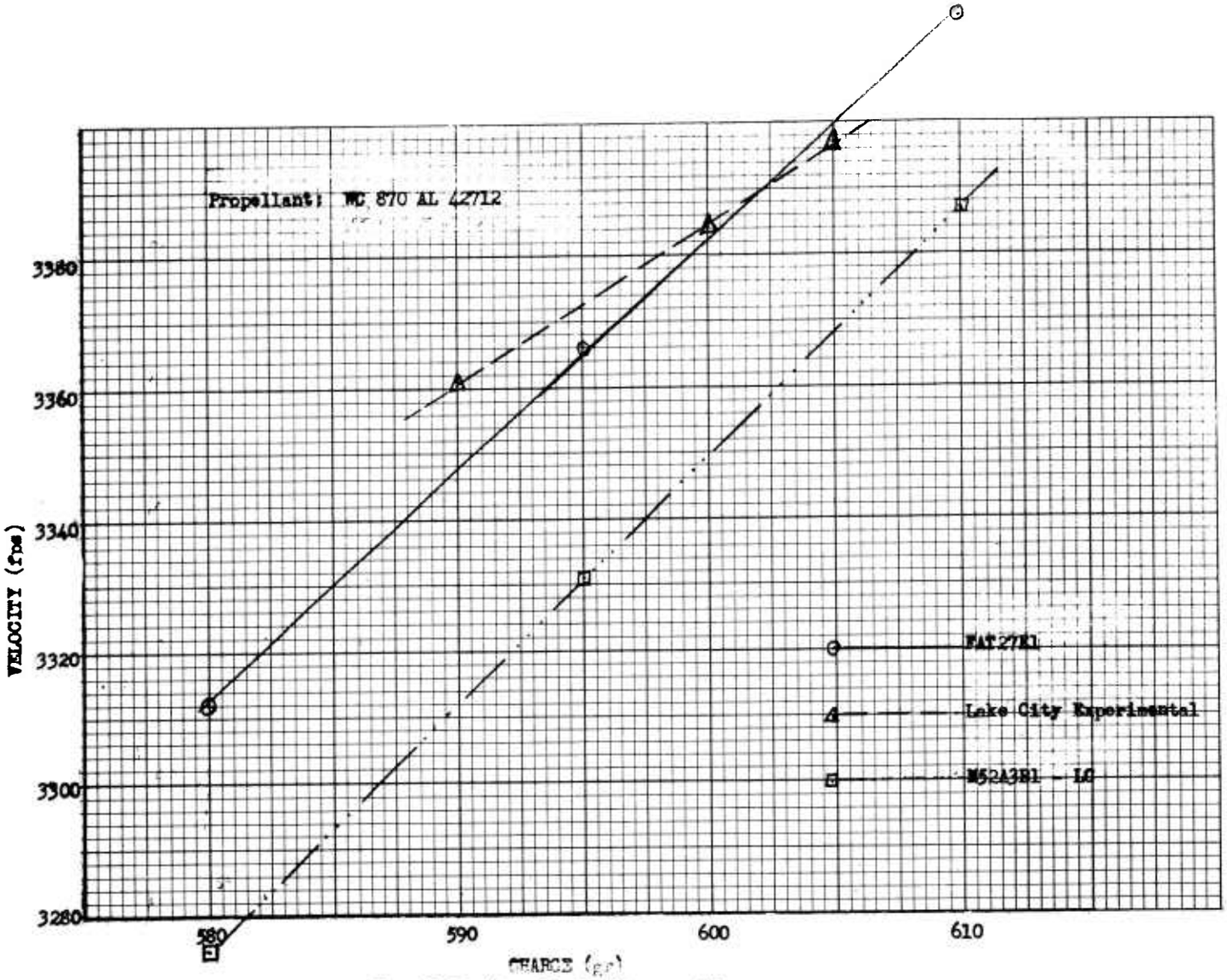


Time relations in small arms ammunition

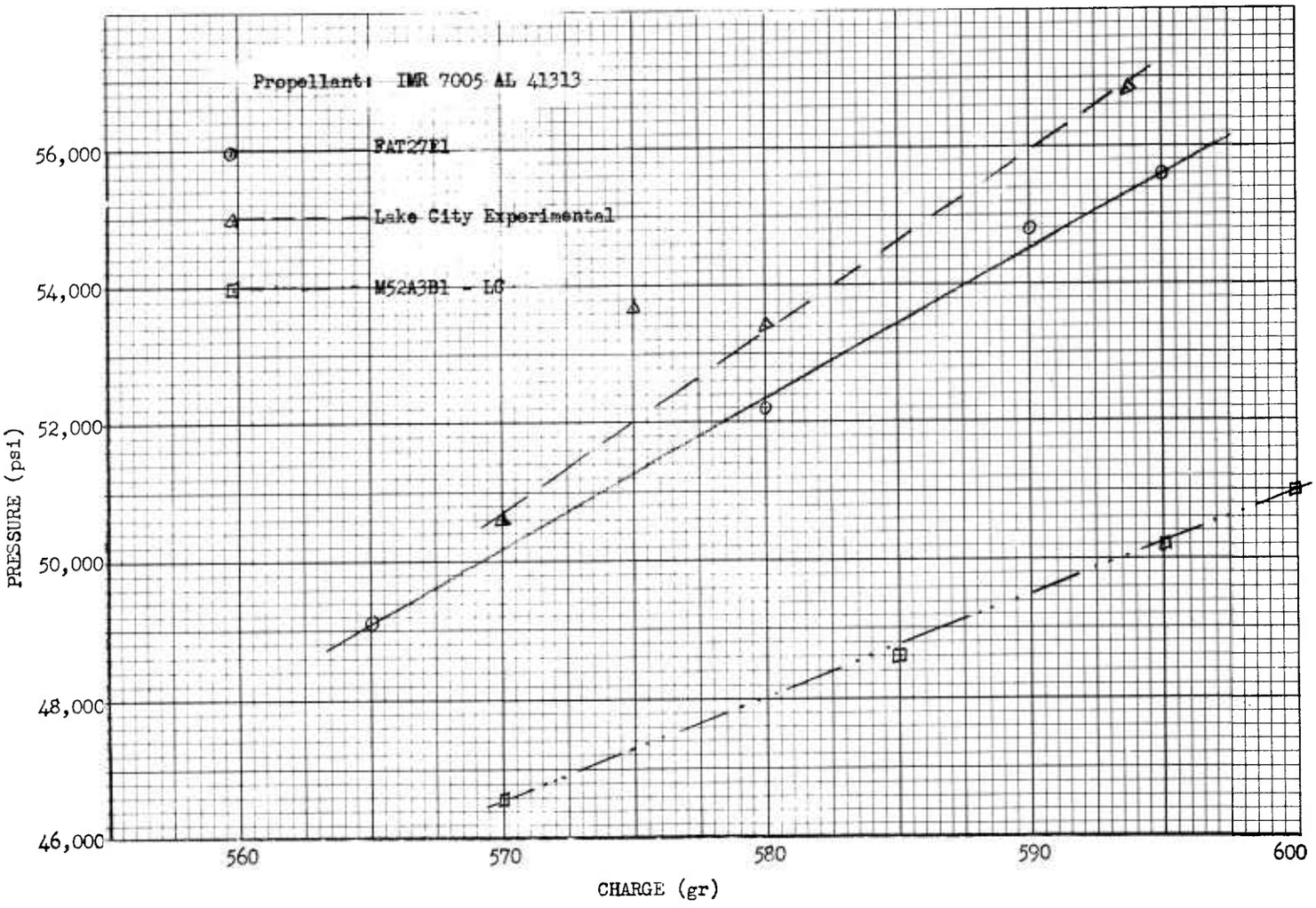
Graph B-1. Velocity vs Charge



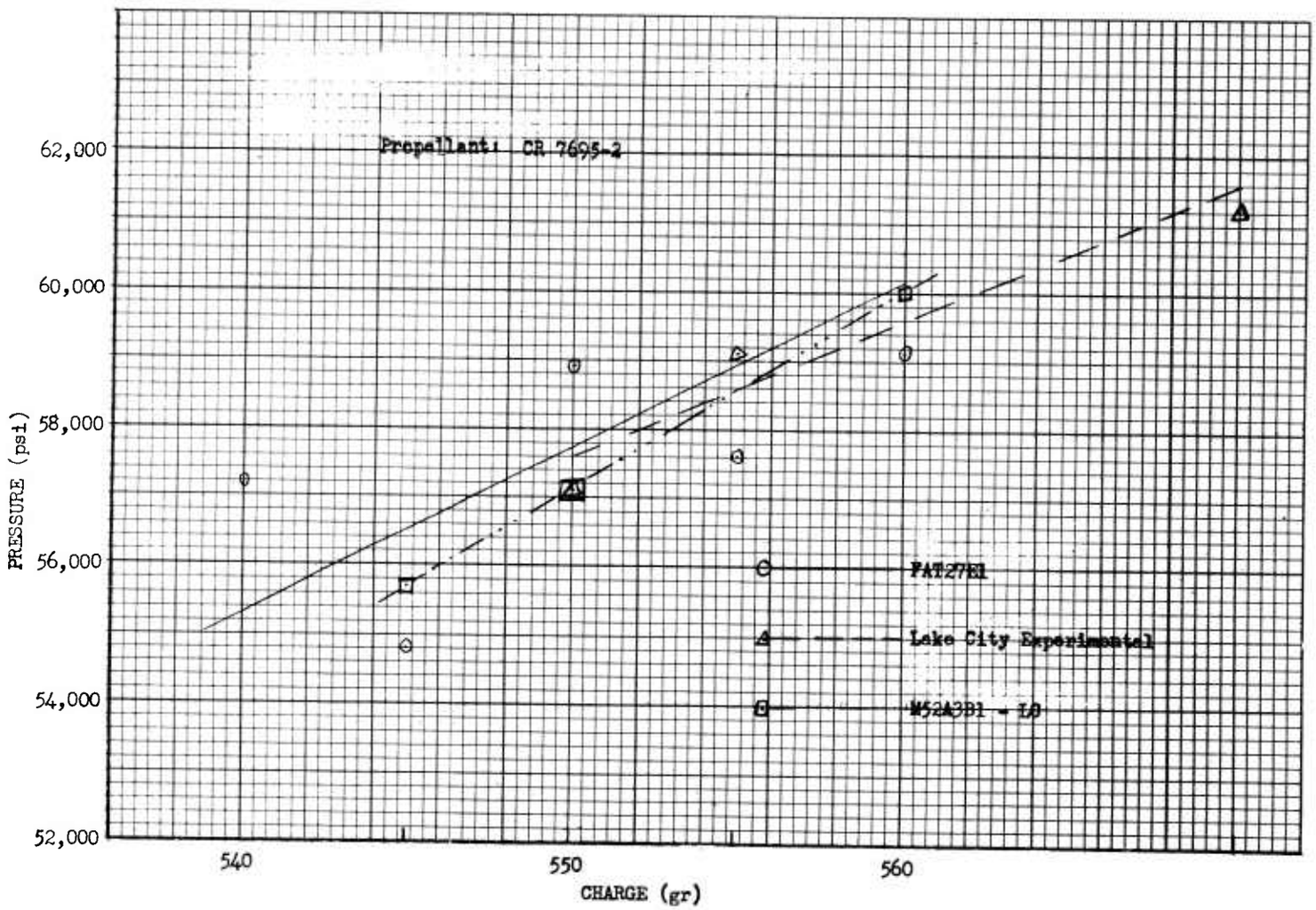
Graph B-2. Velocity vs Charge



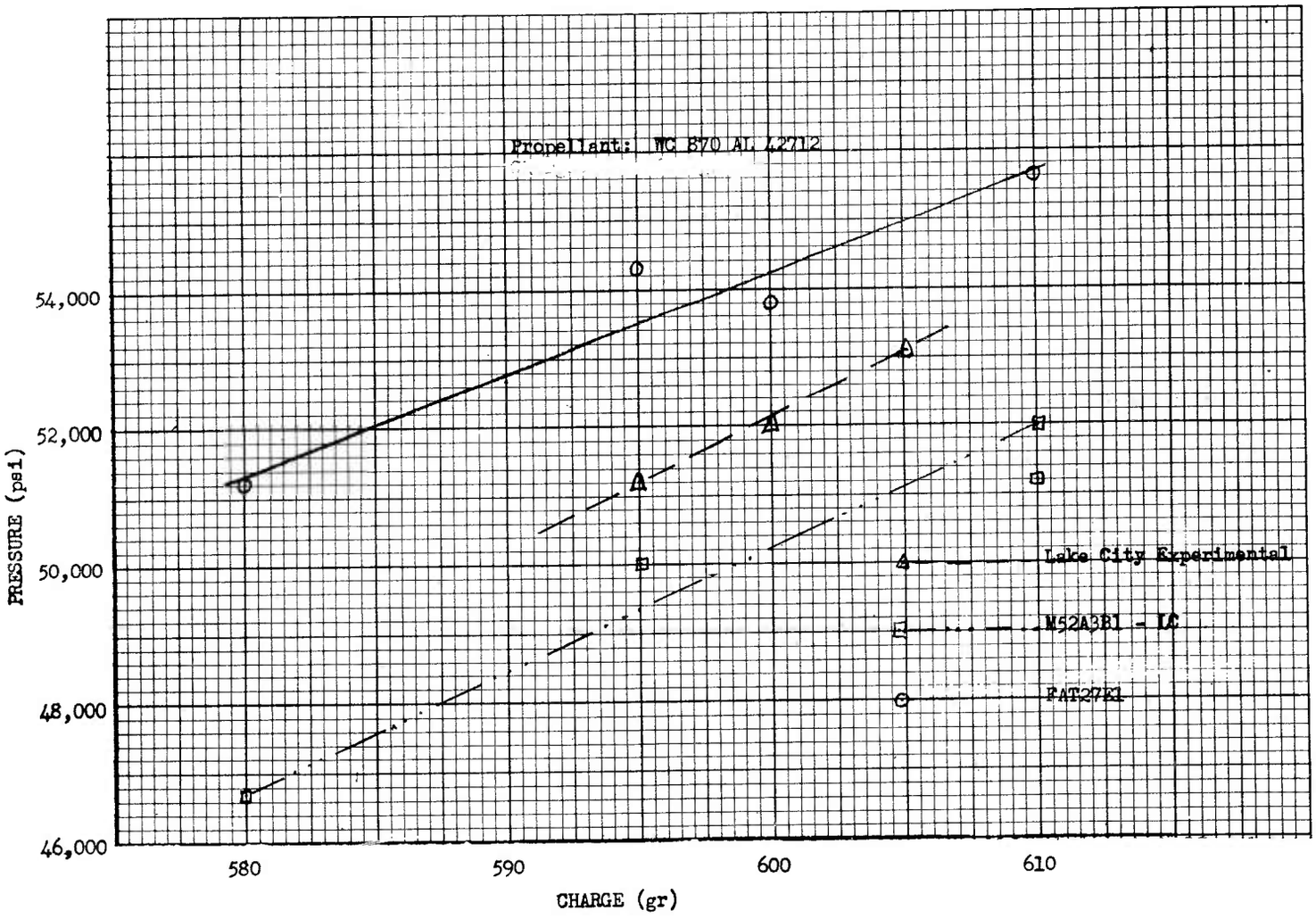
Graph B-3. Velocity vs Charge



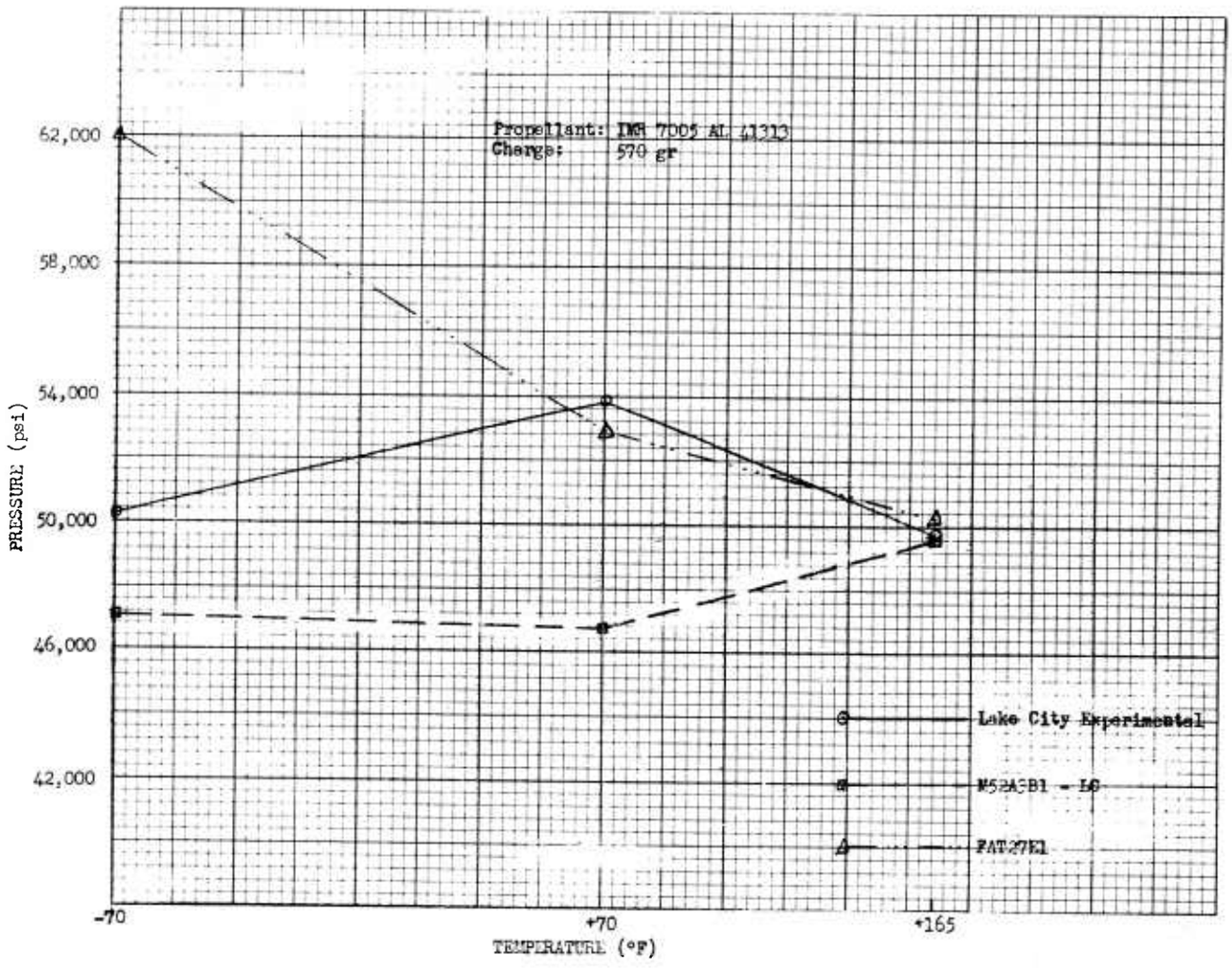
Graph B-4. Pressure vs Charge



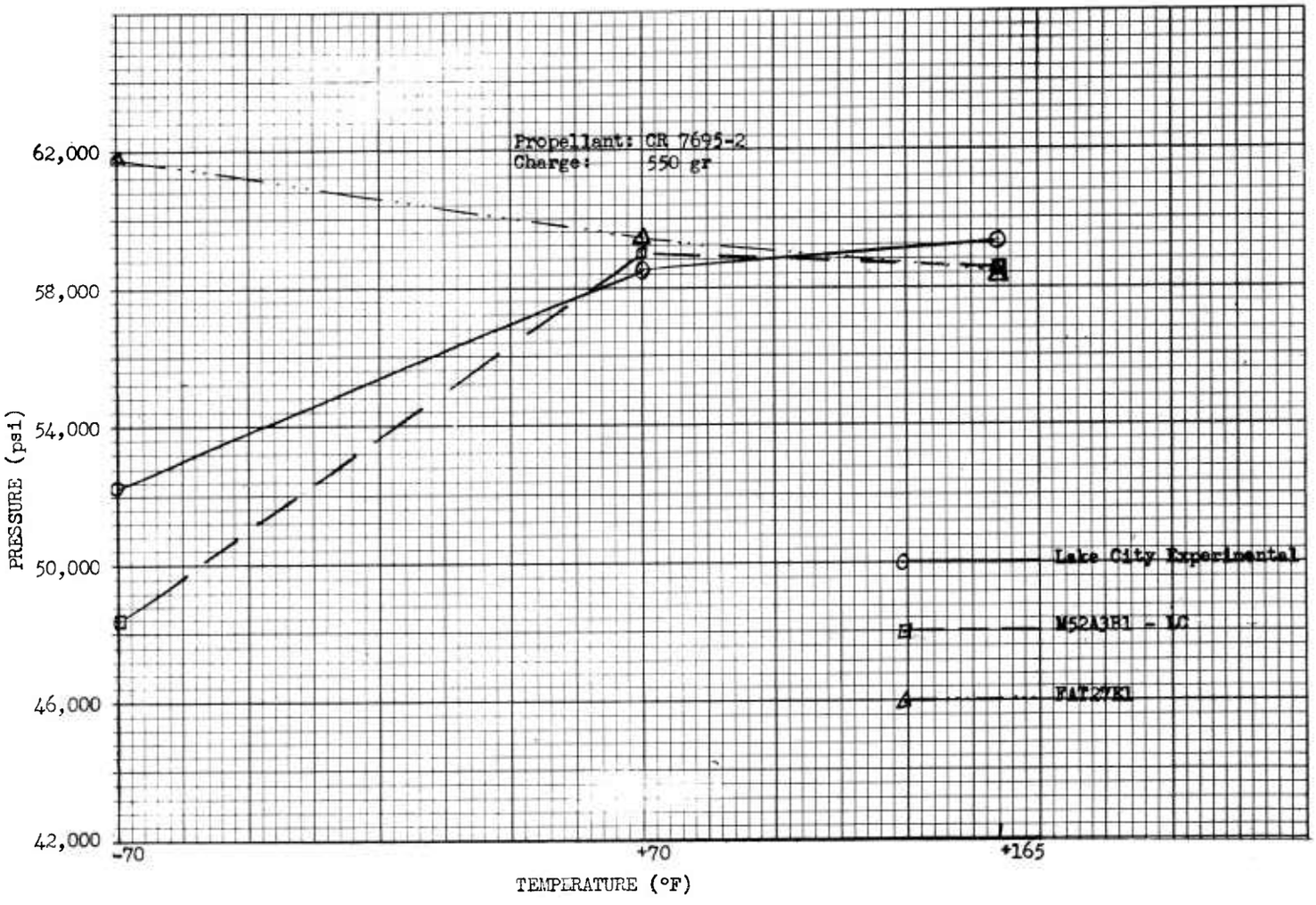
Graph B-5. Pressure vs Charge



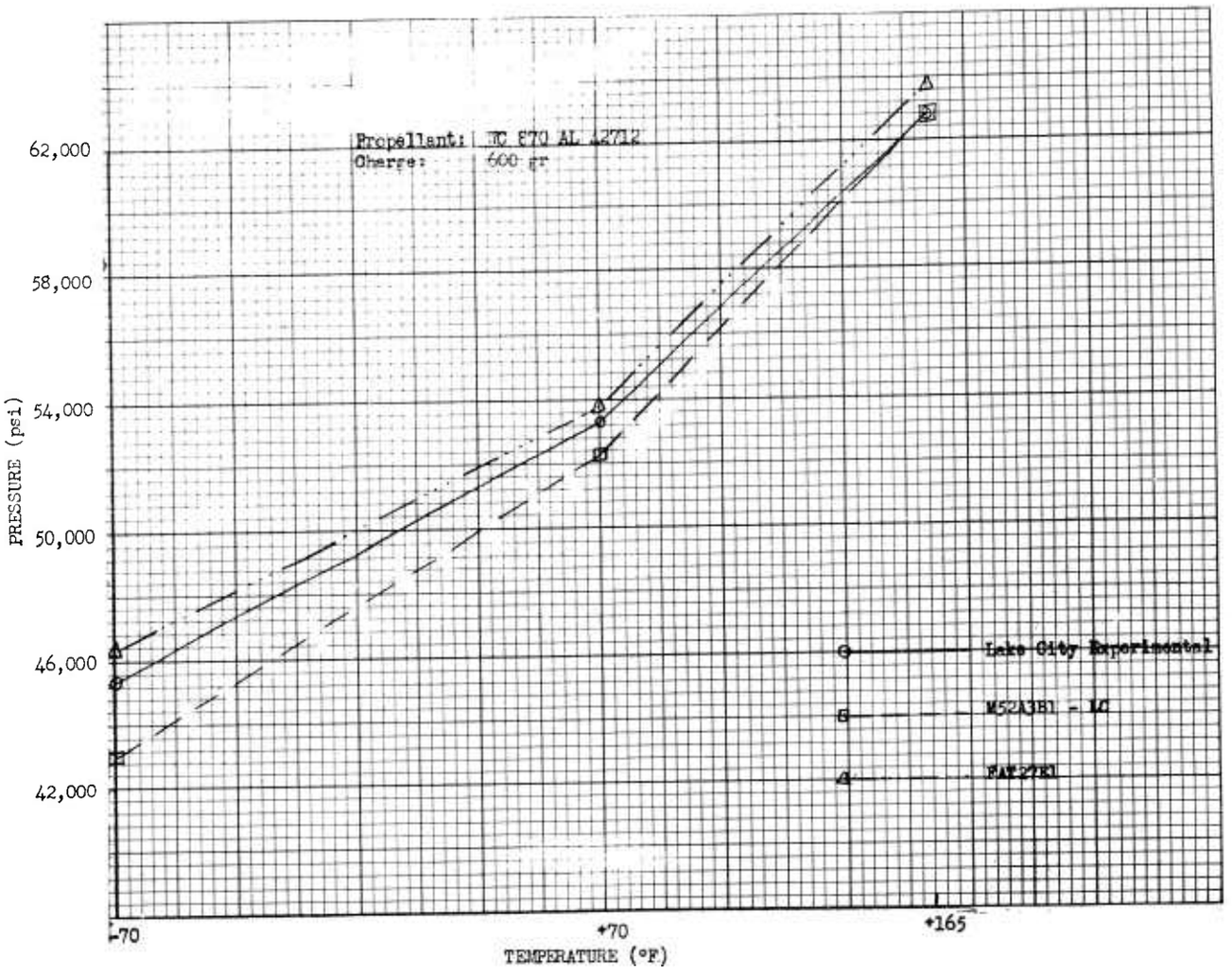
Graph B-6. Pressure vs Charge



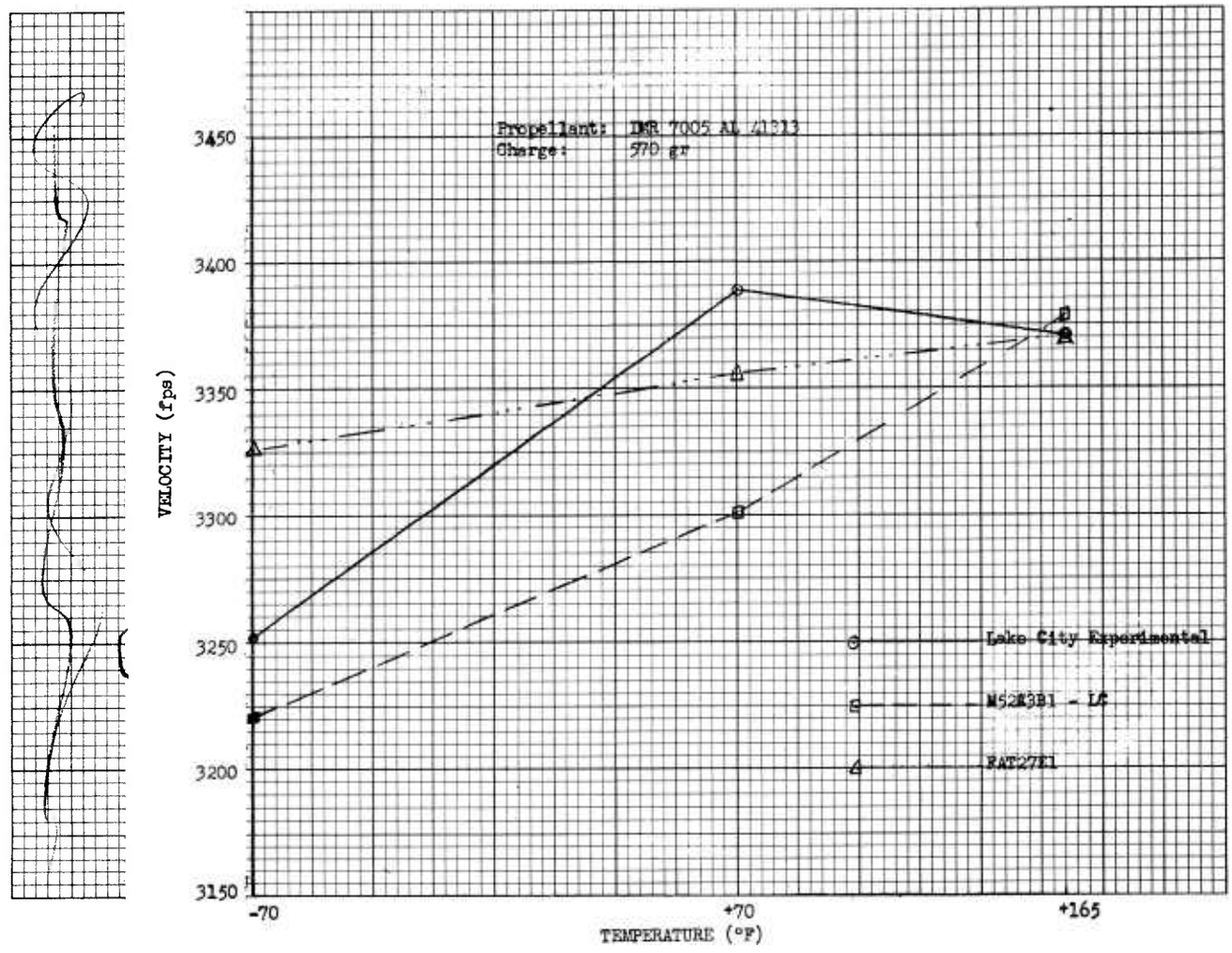
Graph B-7. Pressure vs Temperature
(20-round group, fired in a gage)



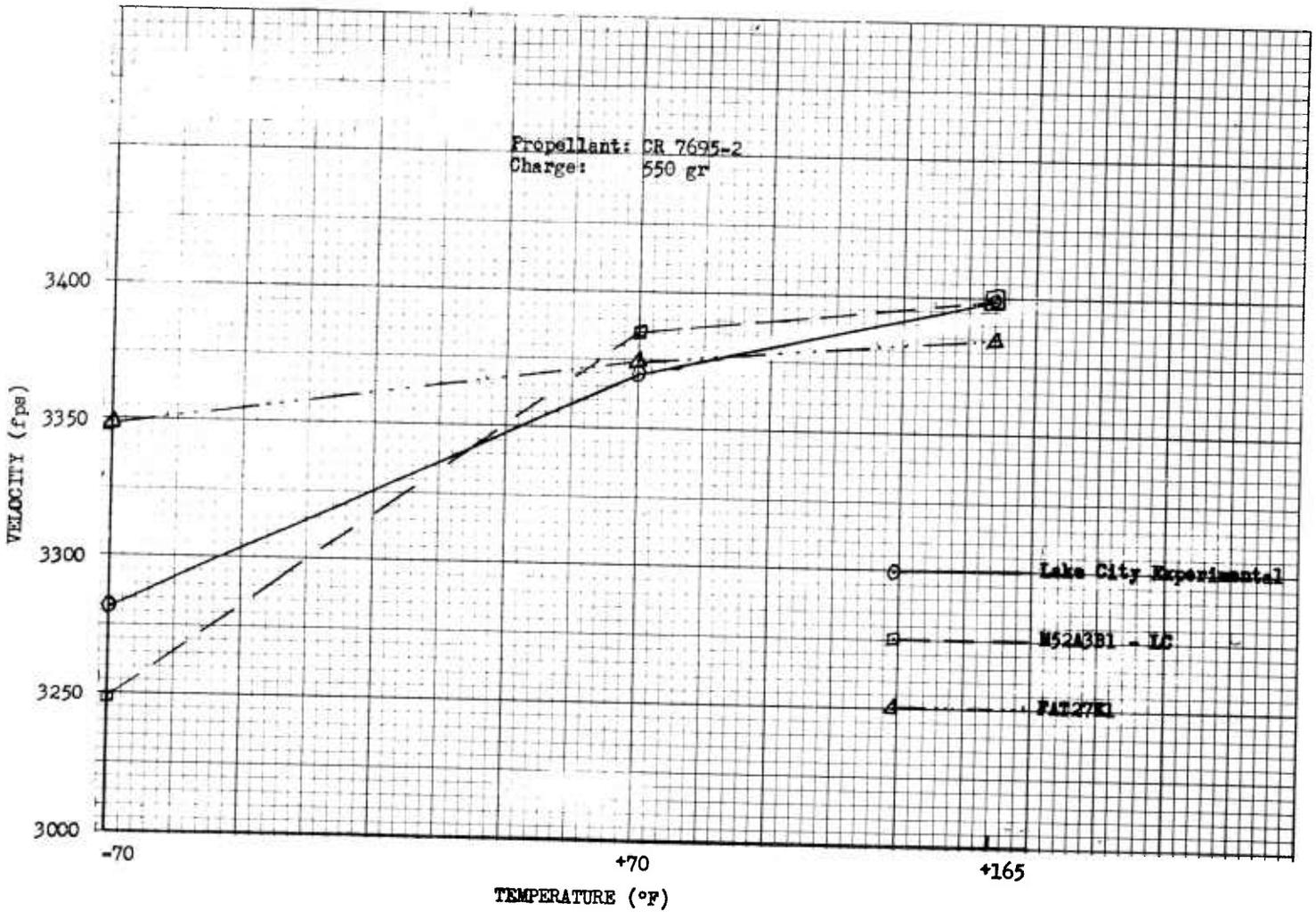
Graph B-8. Pressure vs Temperature
(20-round group, fired in a gage)



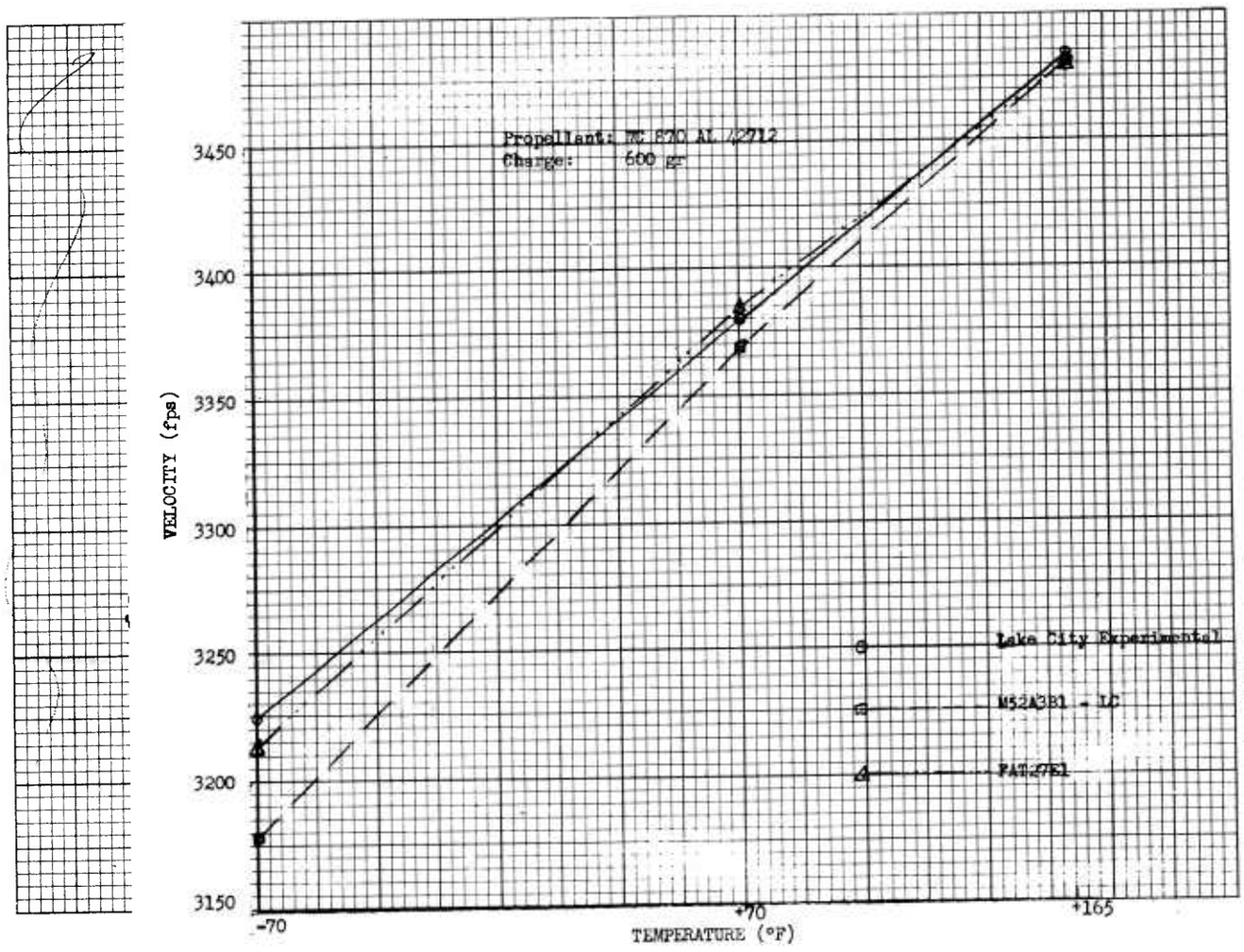
Graph B-9. Pressure vs Temperature
(20-round group, fired in a gage)



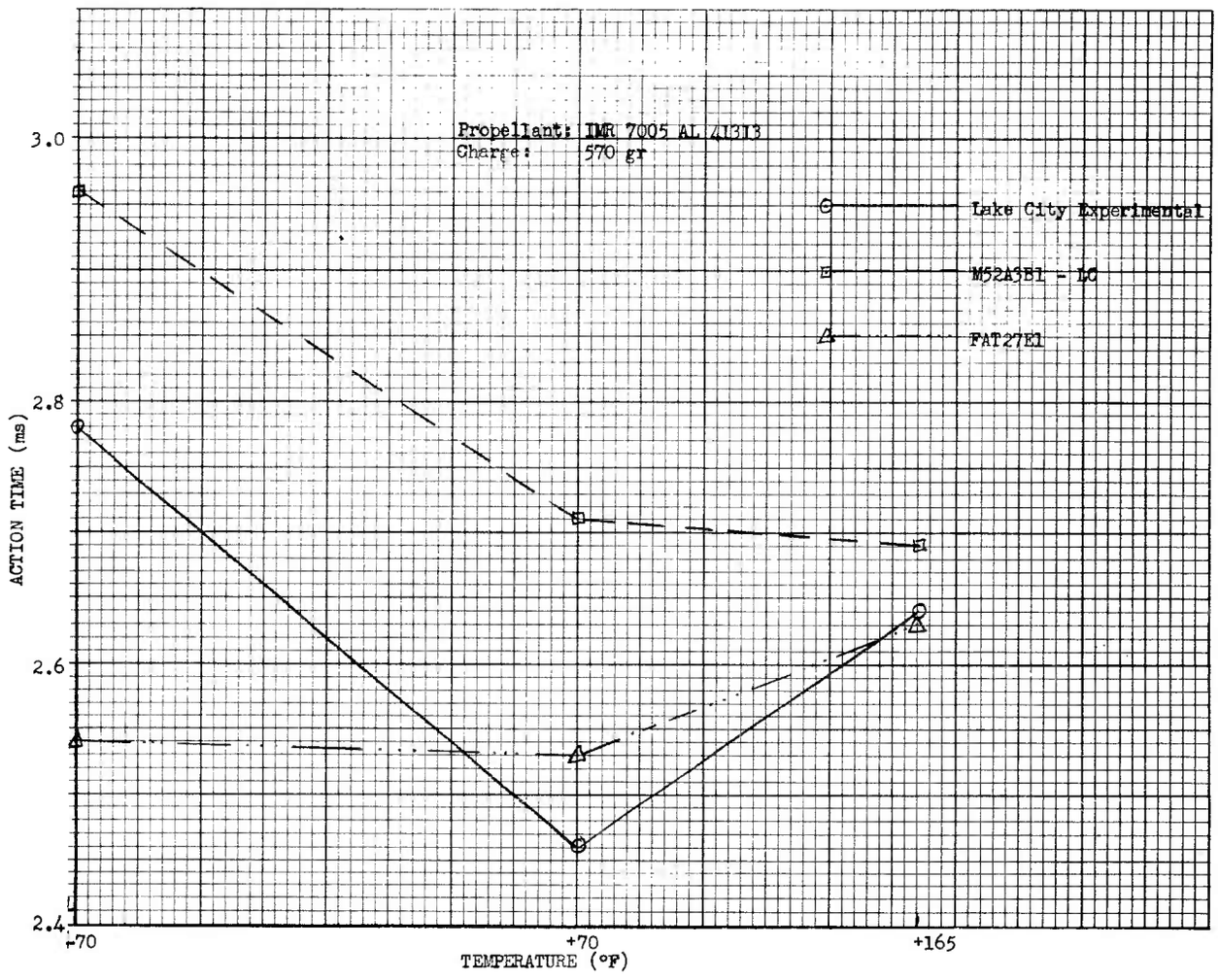
Graph B-10. Velocity vs Temperature
(20-round group, fired in a gage)



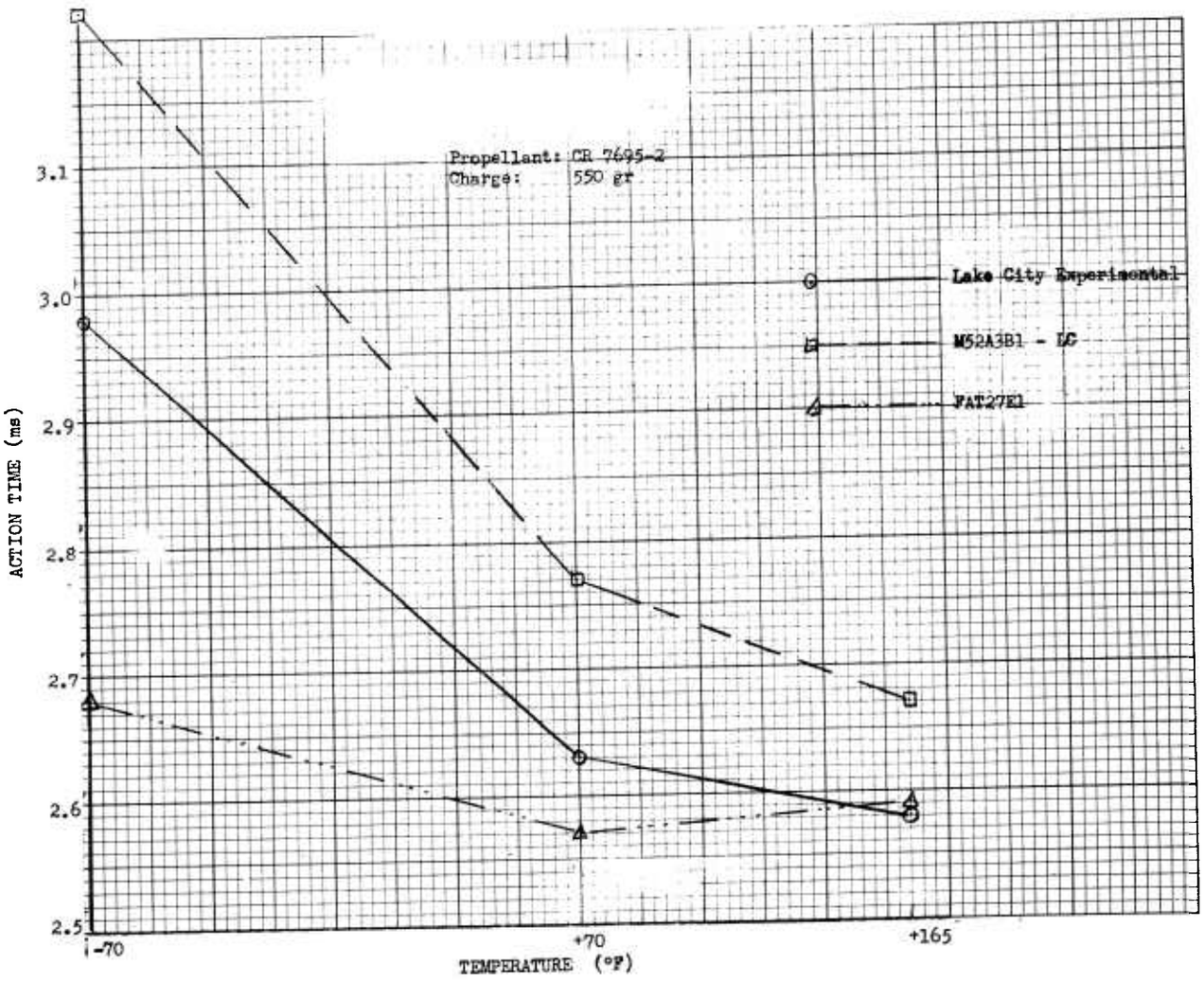
Graph B-11. Velocity vs Temperature
(20-round group, fired in a gage)



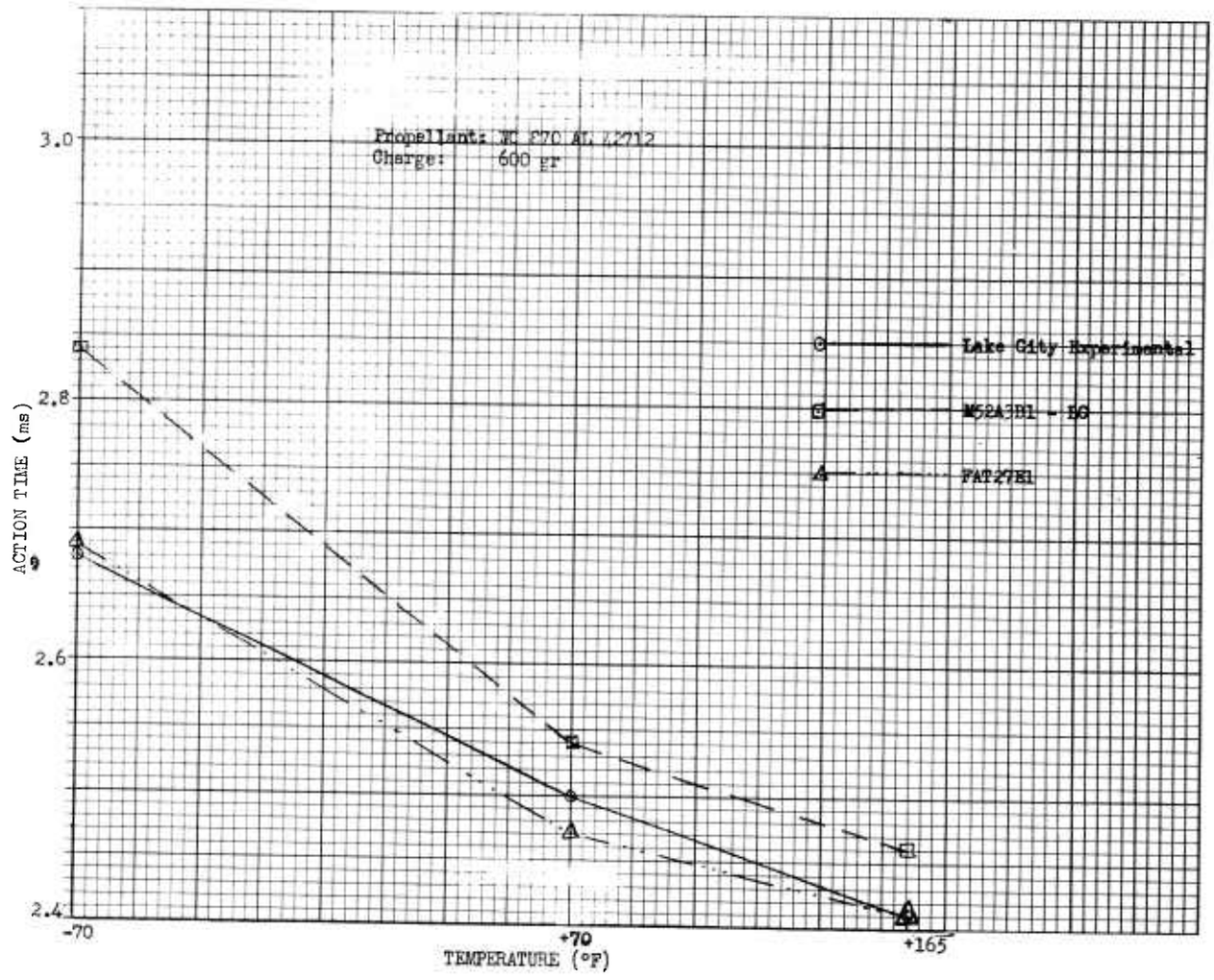
Graph B-12. Velocity vs Temperature
(20-round group, fired in a gage)



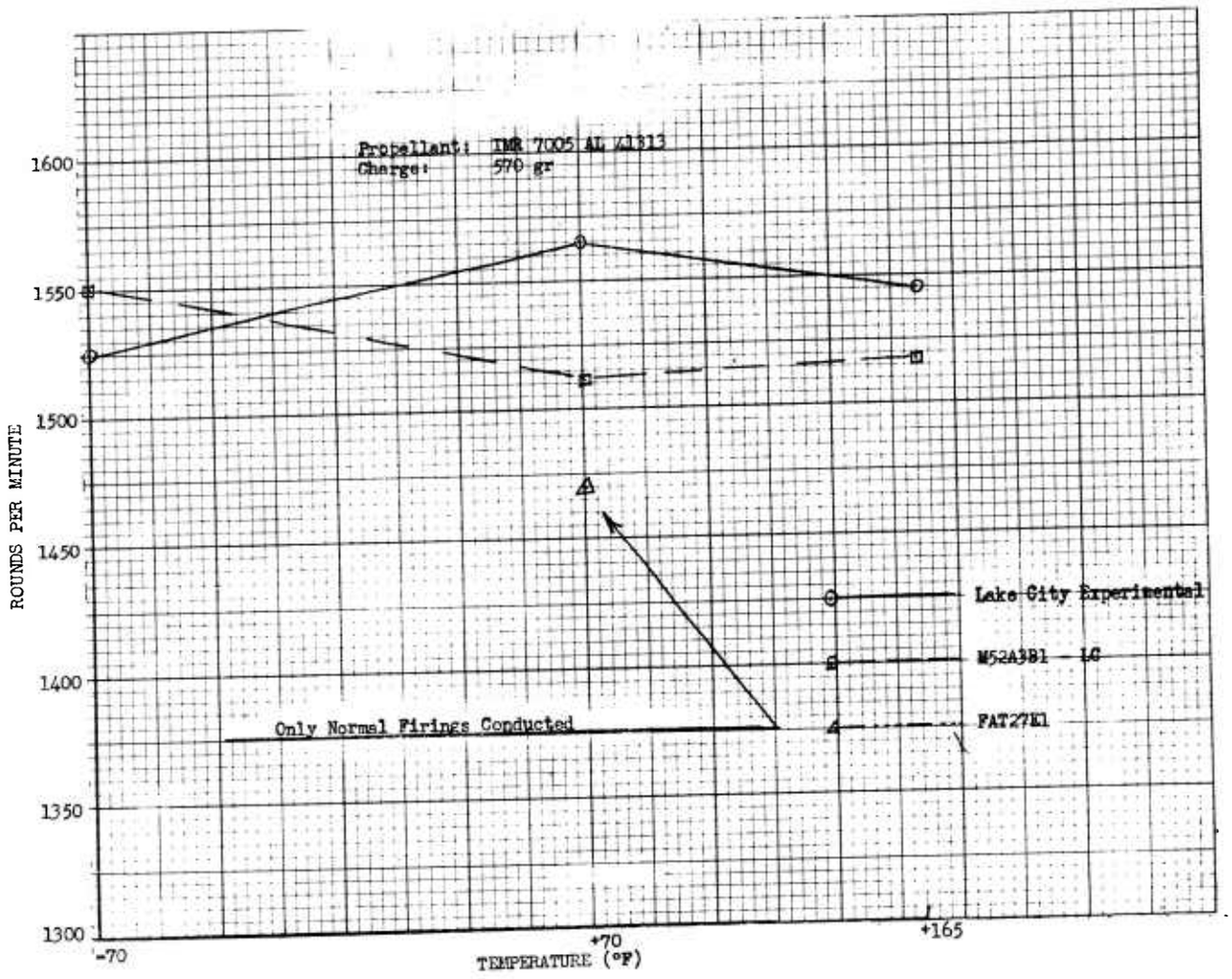
Graph B-13. Action Time vs Temperature
(20-round group, fired in a gage)



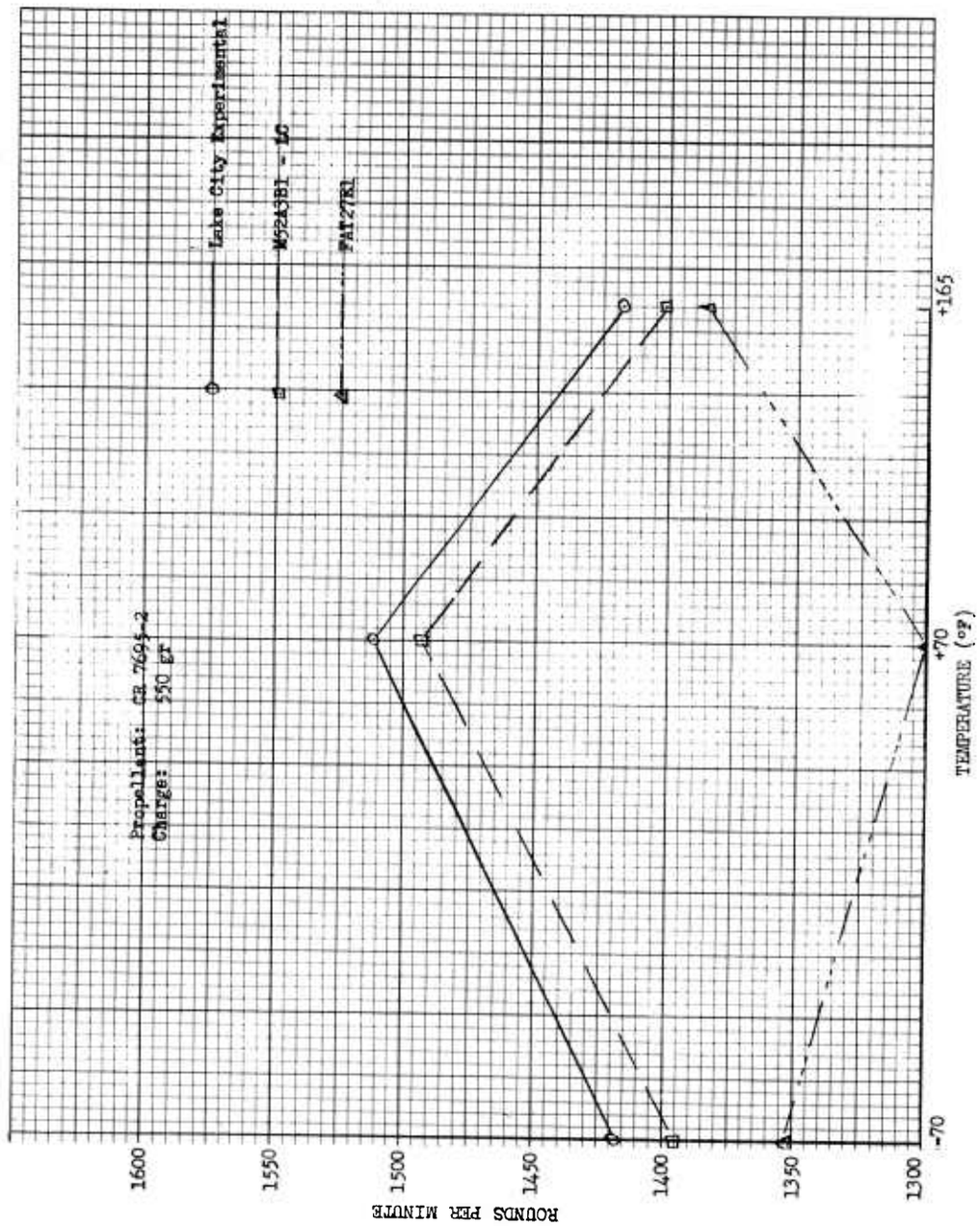
Graph B-14. Action Time vs Temperature
(20-round group, fired in a gage)



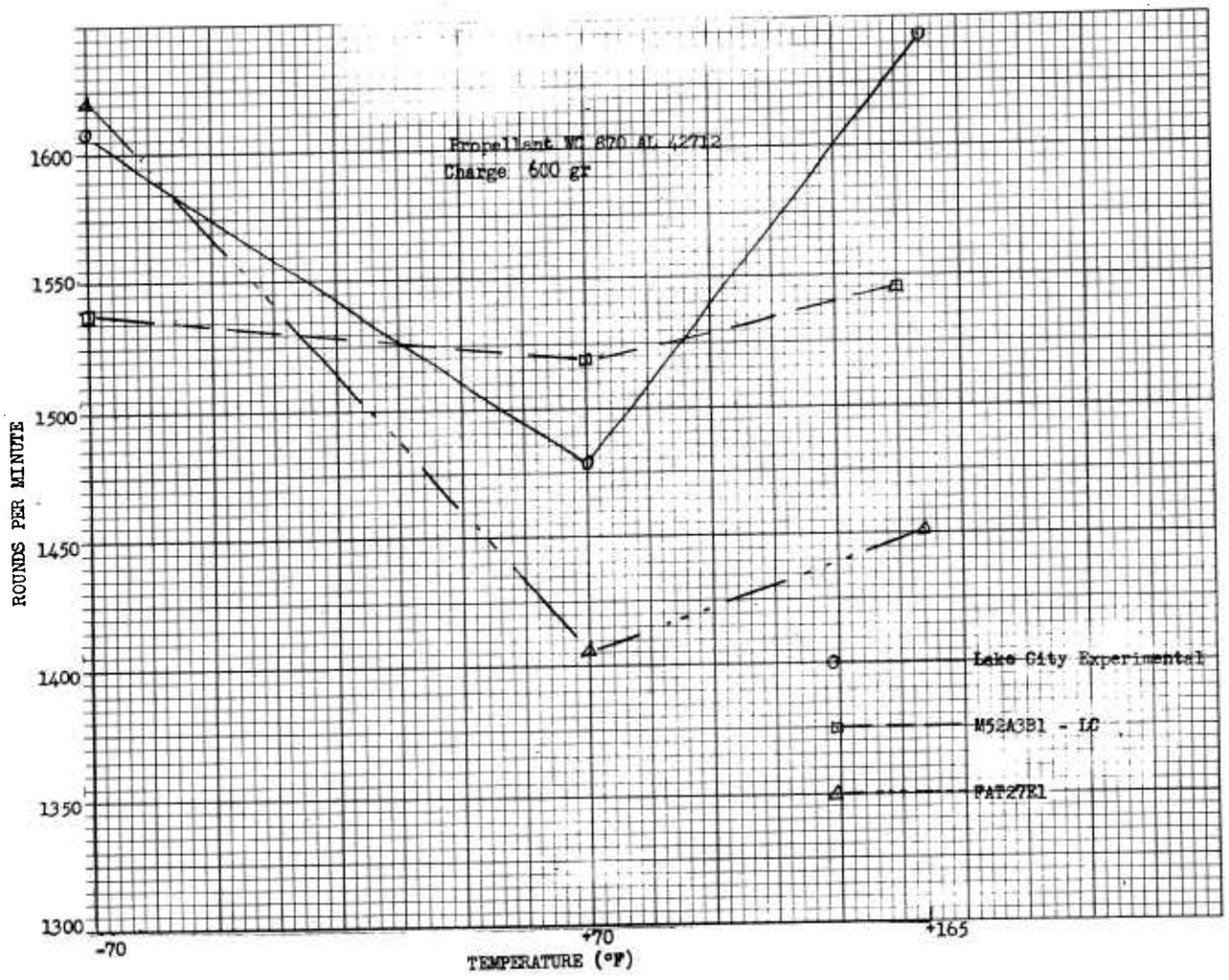
Graph B-15. Action Time vs Temperature
(20-round group, fired in a gage)



Graph B-16. Cyclic Rate vs Temperature
(125-round burst, fired in the M39A2 machine gun)



Graph B-17. Cyclic Rate vs Temperature
(125-round burst, fired in the M39A2 machine gun)



Graph B-18. Cyclic Rate vs Temperature
(125-round burst, fired in the M39A2 machine gun)

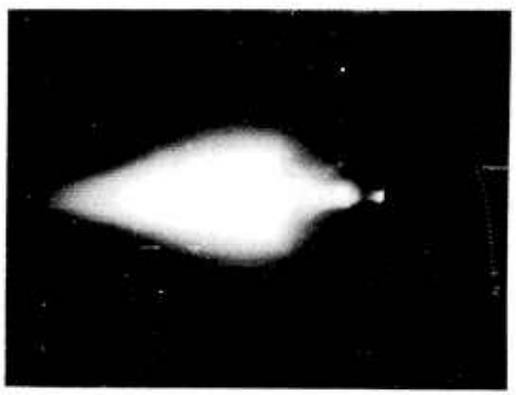
APPENDIX C

PHOTOGRAPHS OF MUZZLE AND BREECH FLASH

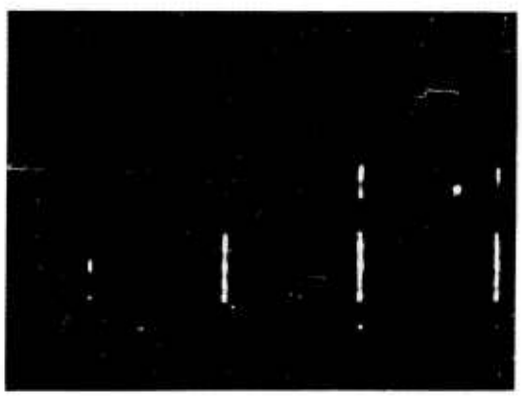
Photographs taken during Frankford Arsenal firing tests of FAT27E1, Lake City experimental, and M52A3B1 primers with IMR 7005, CR 7695, and WC 870 propellants at normal (+70° F), hot (+165° F), and cold (-70° F) temperatures.

Neg 36.231.S 1888/ORD.61

GUN SETUP



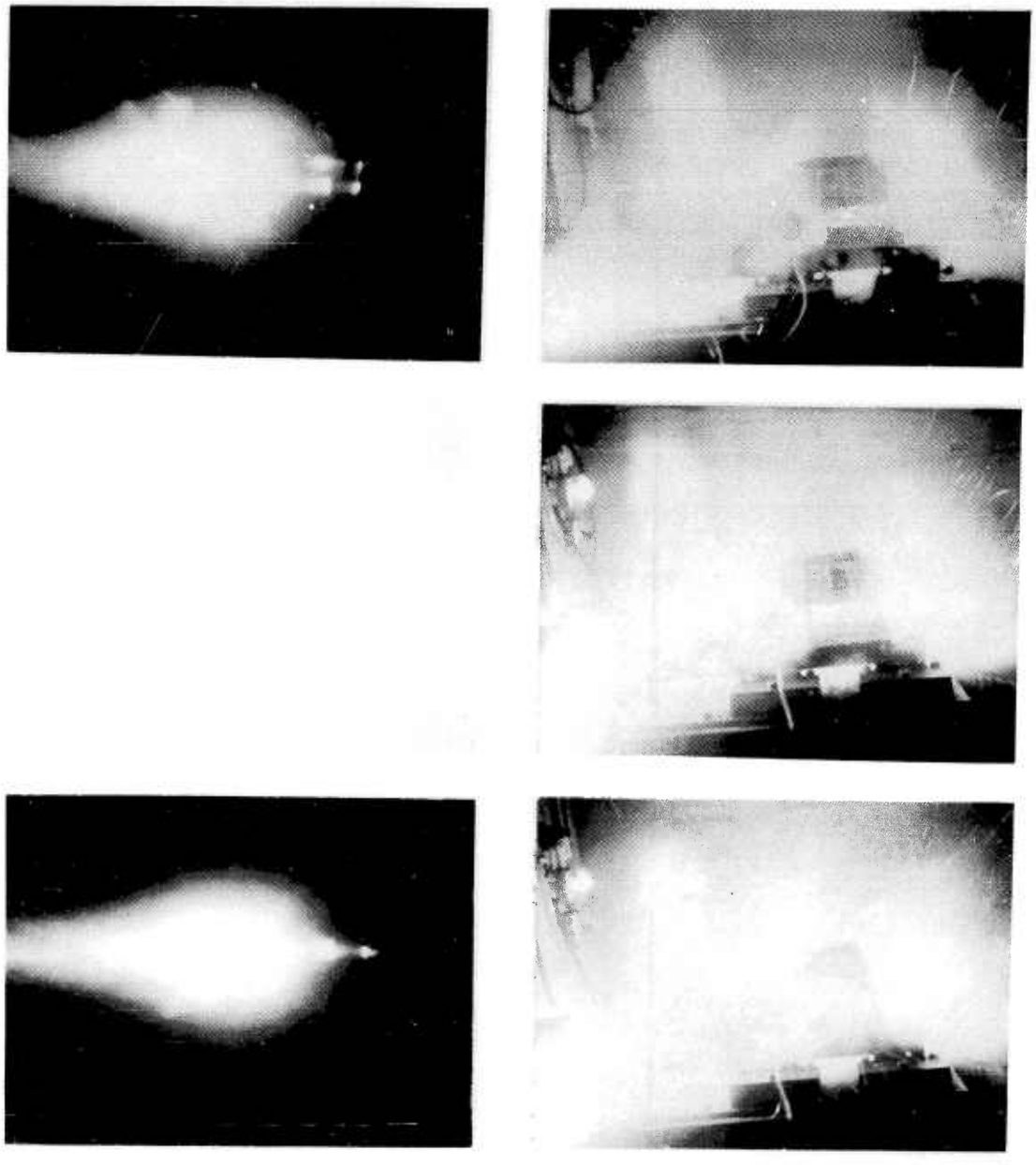
Muzzle



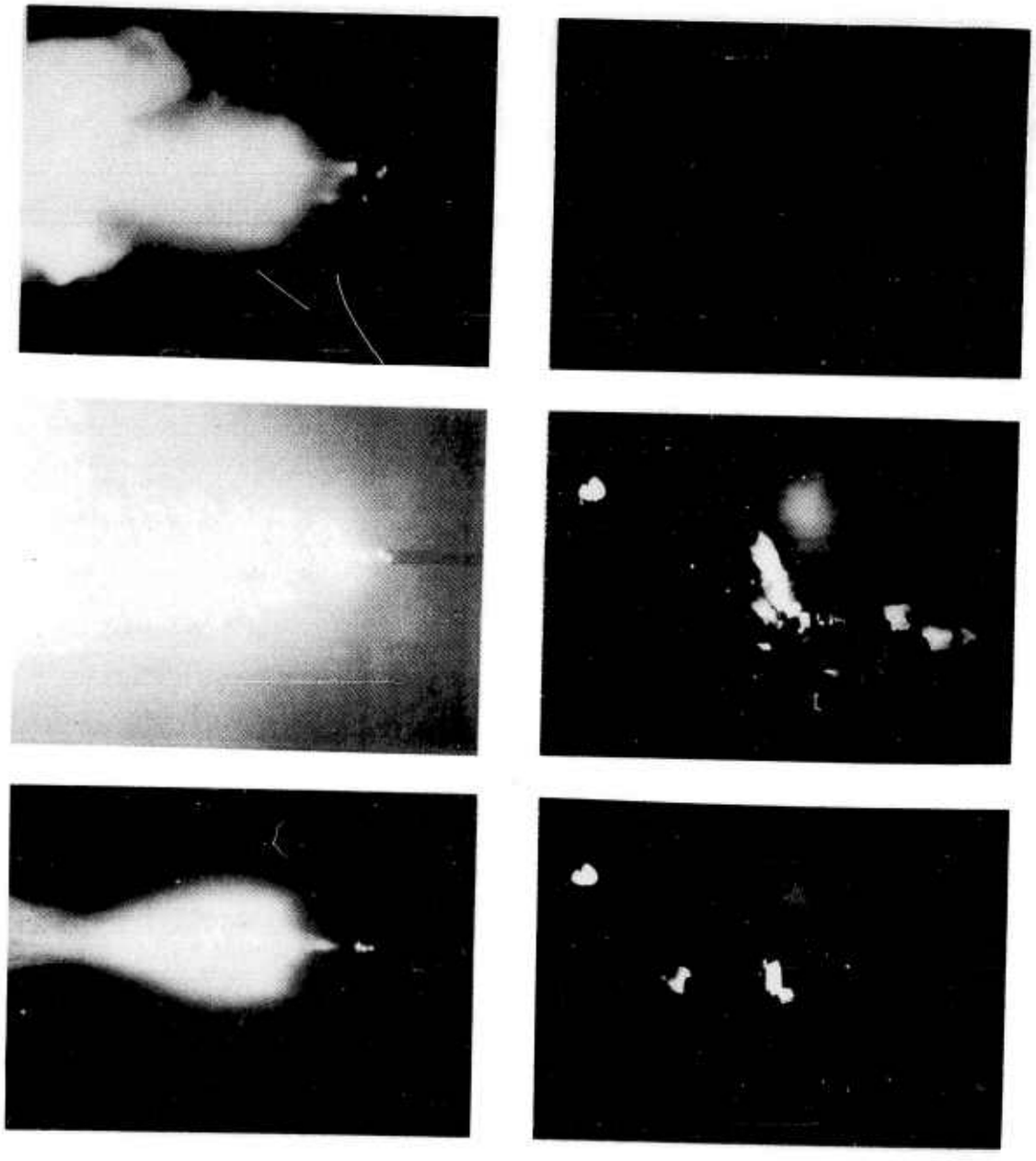
Breech

Test of FAT27E1 Primer and IMR 7005 Propellant. Cumulative flash produced by a 125-round burst fired from a 20mm M39A2 machine gun. Test fired at +70° F.

Neg 36.231.S1895/ORD.61

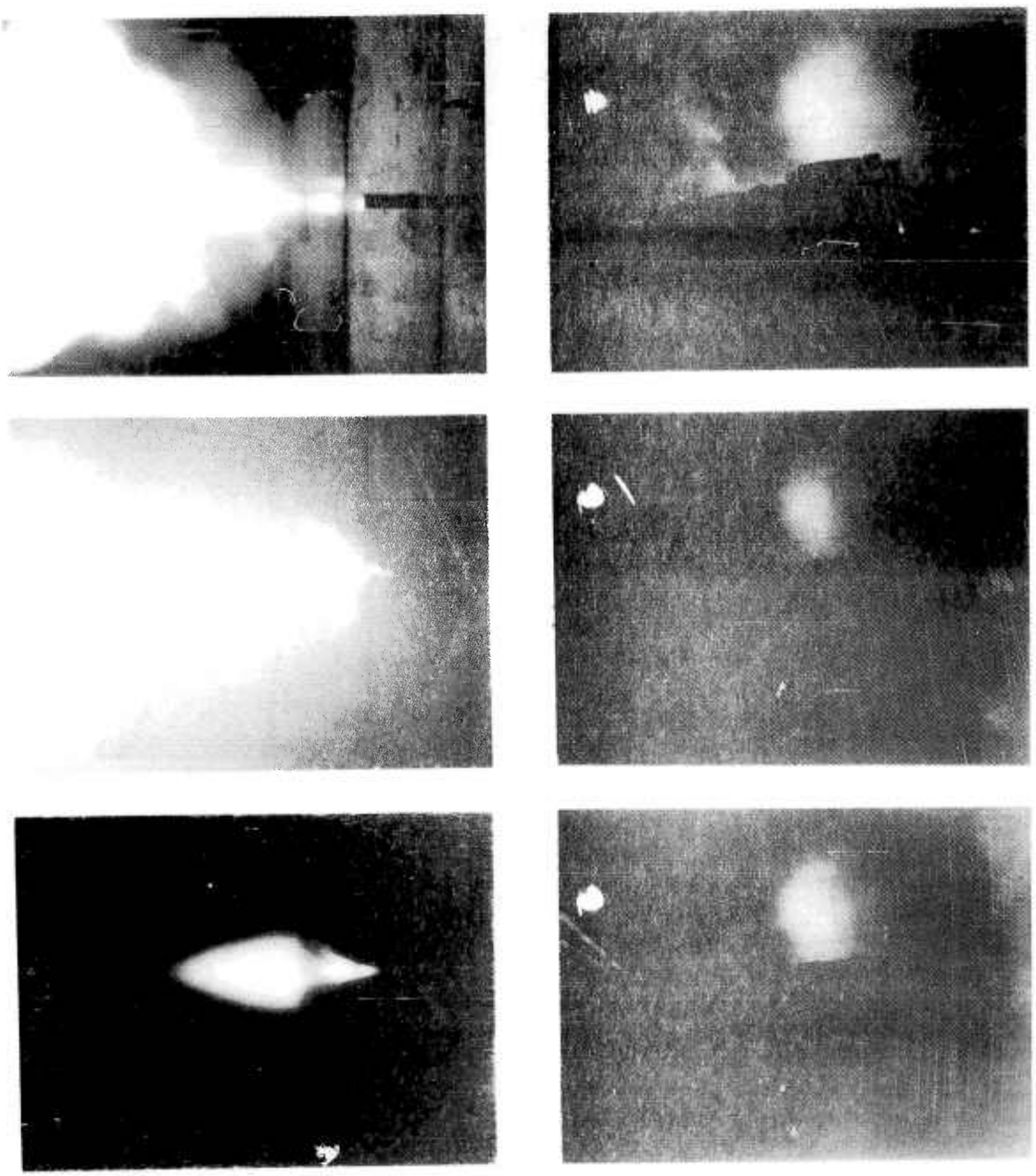


Test of Lake City Experimental Primer and IMR 7005 Propellant. Cumulative flash produced by a 125 round burst fired from a 20 mm M39A2 gun. Top fired at +70° F; Center fired at +165° F; Bottom fired at -65°F.



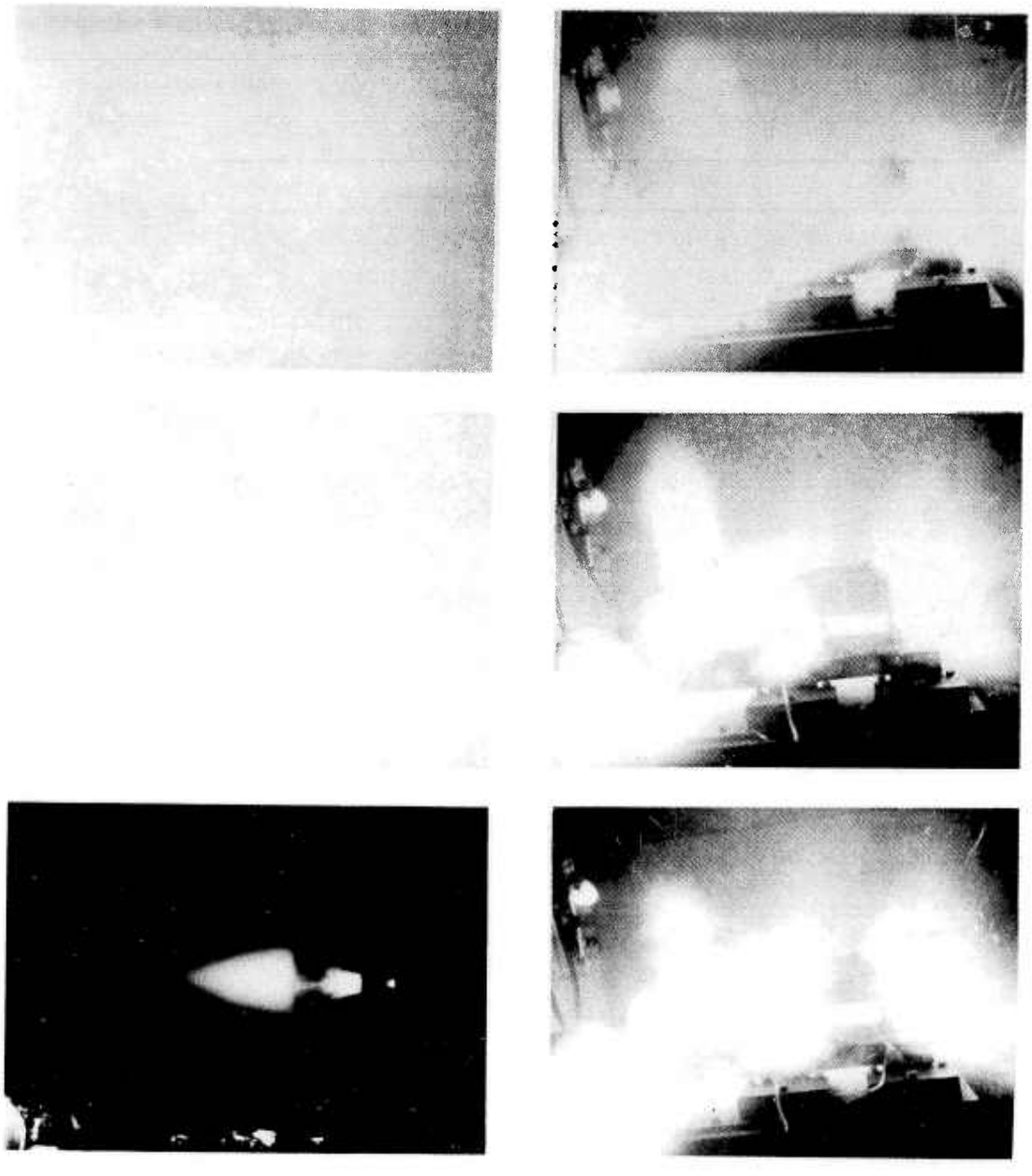
Test of M52A3B1 Primer and IMR 7005 Propellant. Cumulative flash produced by a 125 round burst fired from a 20 mm M39A2 gun. Top fired at +70° F; Center fired at +165° F; Bottom fired at -65° F.

Neg 36.231.S1894/ORD.61



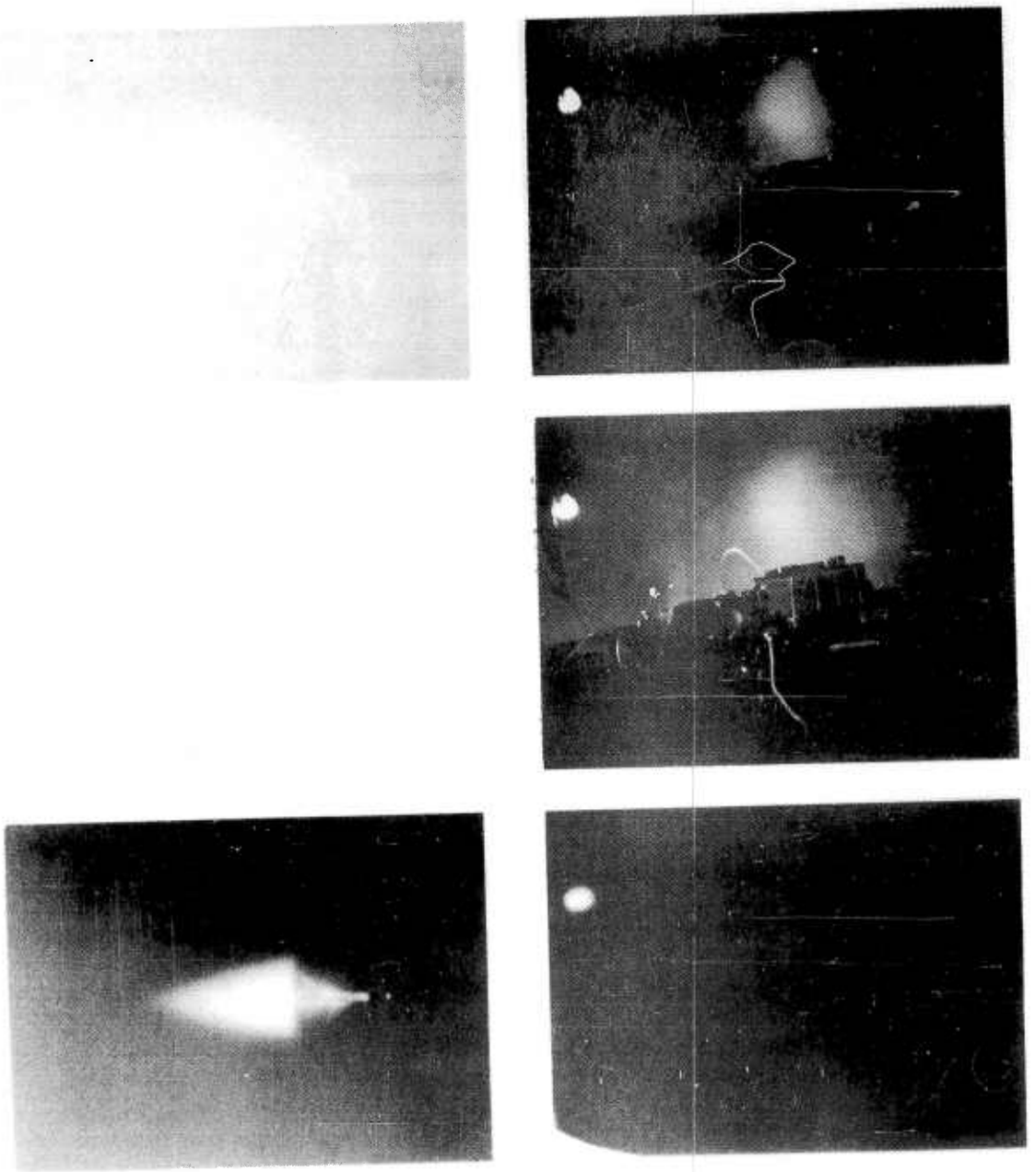
Test of FAT 27E1 Primer and CR 7695 Propellant. Cumulative flash produced by a 125 round burst fired from a 20 mm M39A2 gun. Top fired at +70° F; Center fired at +165° F; Bottom fired at -65° F.

Neg 36.231.S1889/ORD.61



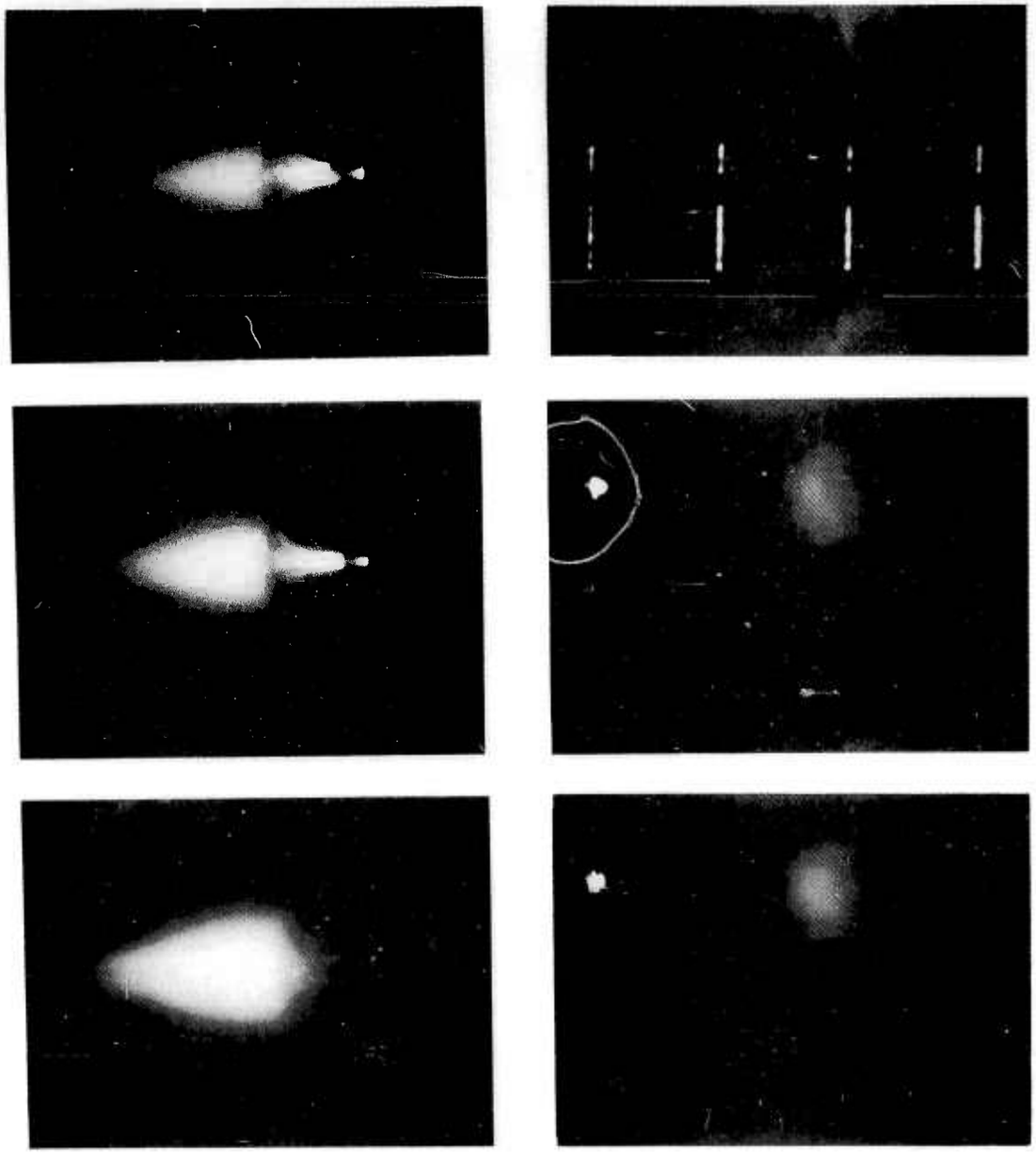
Test of Lake City Experimental Primer and CR 7695 Propellant. Cumulative flash produced by a 125 round burst fired from a 20 mm M39A2 gun. Top fired at +70° F; Center fired at +165° F; Bottom fired at -65° F.

Neg. 36.231.S1890/ORD.61



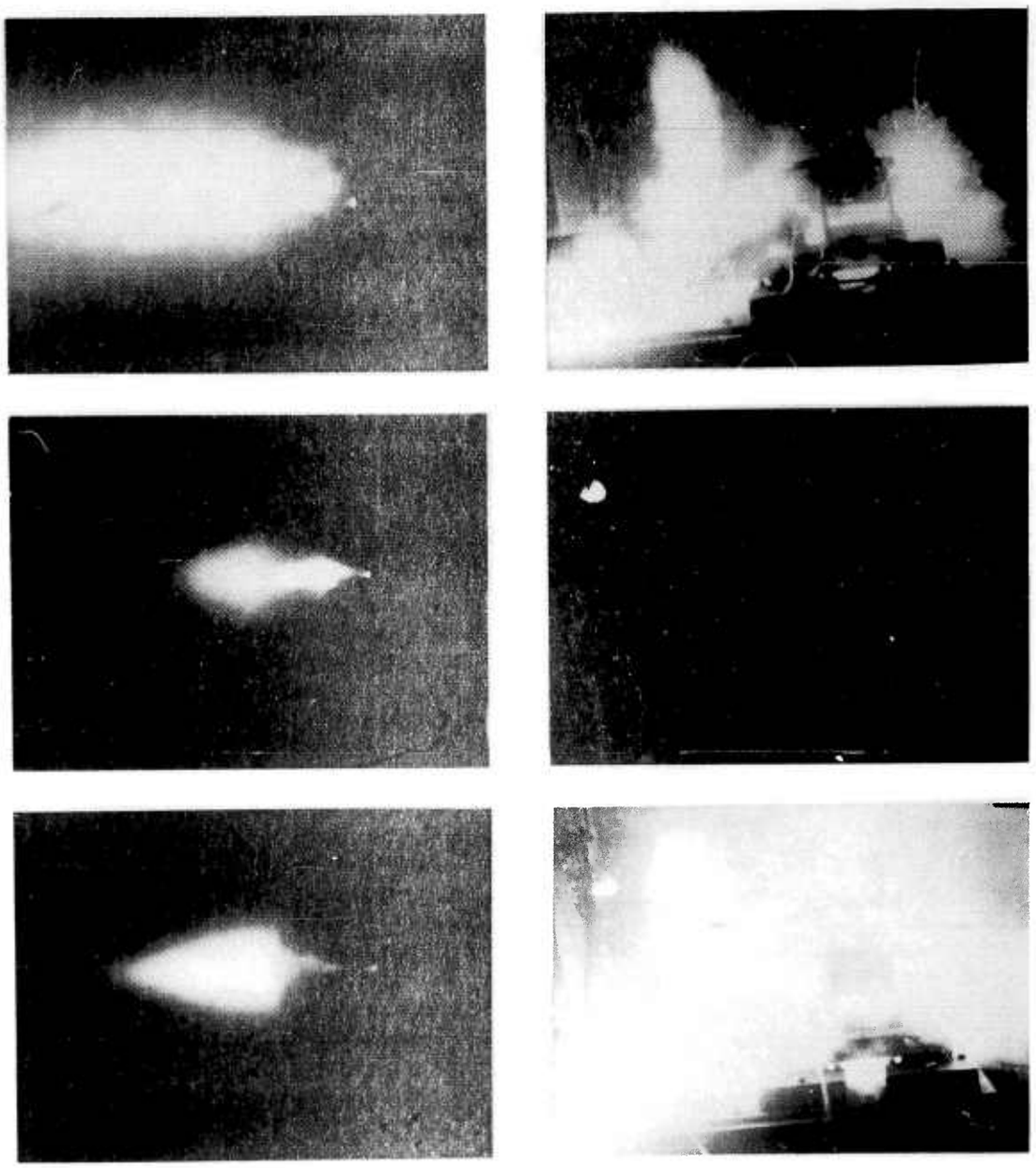
Test of M52A3B1 Primer and CR 7695 Propellant. Cumulative flash produced by a 125 round burst fired from a 20 mm M39A2 gun. Top fired at +70° F; Center fired at +165° F; Bottom fired at -65° F.

Neg. 36.231.S1891/ORD.61



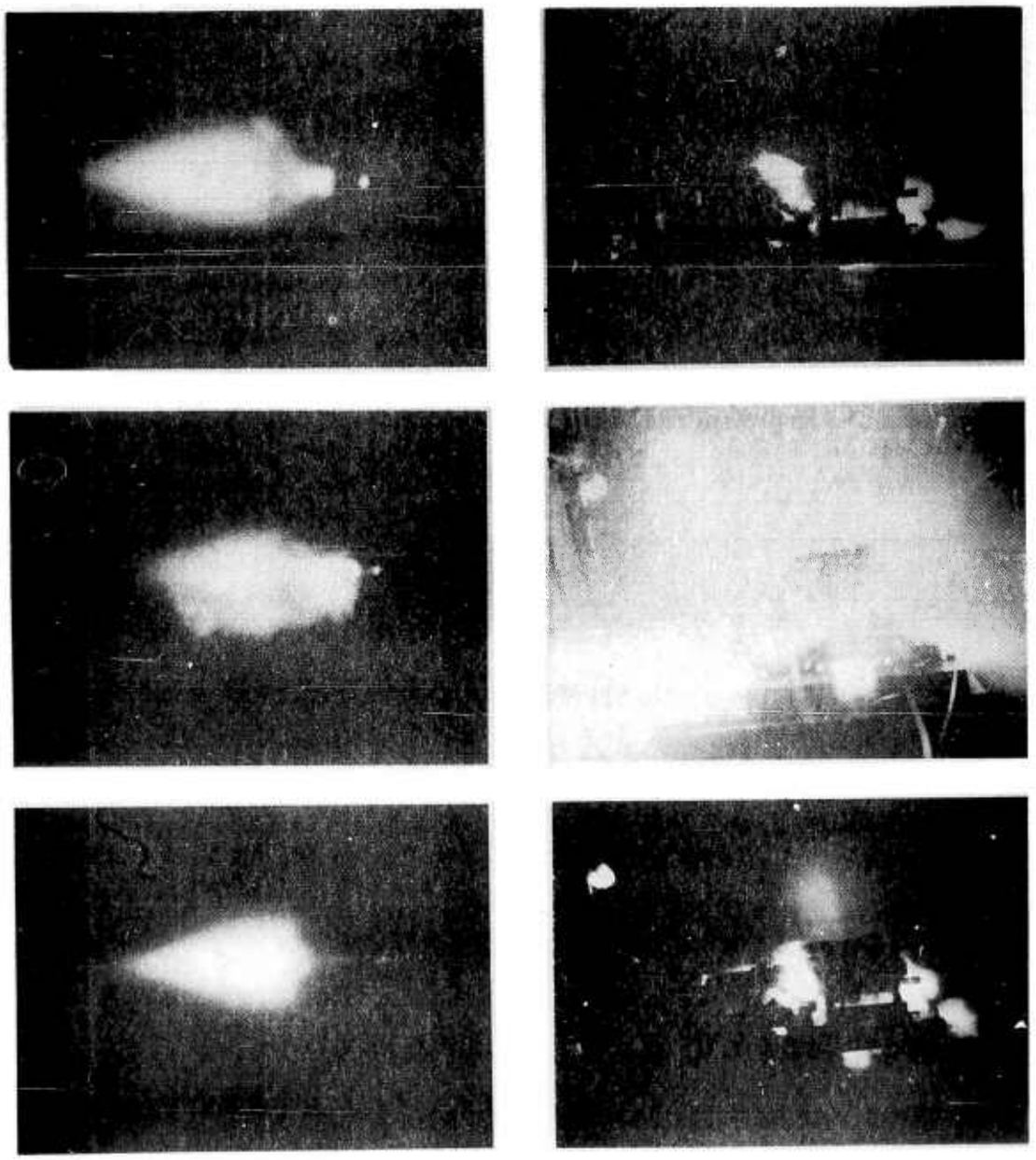
Test of FAT27E1 Primer and WC 870 Propellant. Cumulative flash produced by a 125 round burst fired from a 20 mm M39A2 gun. Top fired at +70° F; Center fired at +165° F; Bottom fired at -65° F.

Neg. 36.231.S1893/ORD.61



Test of Lake City Experimental Primer and WC 870 Propellant. Cumulative flash produced by a 125 round burst fired from a 20 mm M39A2 gun. Top fired at +70° F; Center fired at +165° F; Bottom fired at -65° F.

Neg. 36.231.S1892/ORD.61



Test of M52A3B1 Primer and WC 870 Propellant. Cumulative flash produced by a 125 round burst fired from a 20 mm M39A2 gun. Top fired at +70° F; Center fired at +165° F; Bottom fired at -65° F.

DISTRIBUTION

1 - Chief of Ordnance
Department of the Army
Washington 25, D. C.
Attn: ORDTS

1 - Attn: ORDIM

1 - U.S. Army Ordnance
Liaison Office
U.S. Naval Explosive
Ordnance Disposal
Technical Center
U.S. Naval Propellant Plant
Indian Head, Maryland

1 - U.S. Army Liaison Office
U.S. Naval School
Explosive Ordnance Disposal
U.S. Naval Propellant Plant
Indian Head, Maryland

1 - Commanding General
U.S. Army Ordnance
Ammunition Command
Joliet, Illinois
Attn: Chemical Group

1 - Commanding Officer
Air Proving Ground Center
Eglin Air Force Base
Florida

1 - Commanding Officer
U.S. Army Ordnance
Arsenal - Picatinny
Dover, New Jersey

5 - Commanding Officer
Air Research & Development
Command
Andrews Air Force Base
Maryland
Attn: RDT-DAG

2 - Commanding Officer
U.S. Army Ordnance Arsenal -
Lake City
Independence, Missouri

3 - Commanding General
Aberdeen Proving Ground
Maryland
Attn: ORDBG-D & PS

1 - Attn: Ballistic Research Lab.

2 - Attn: Library, ORDBG-LM

3 - Commanding General
White Sands Proving Ground
New Mexico
Attn: Technical Librarian

1 - Commanding Officer
U.S. Army Research Office -
Durham
Box CM, Duke Station
Durham, North Carolina

1 - Commanding Officer
Springfield Armory
Springfield 1, Mass.
Attn: Engineering Dept

1 - Bureau of Ordnance
Department of the Navy
Washington 25, D. C.
Attn: AD3, Tech Library

1 - Attn: Re S6

1 - Attn: RD W3a

1 - Attn: SP-27

2 - Commanding Officer
U.S. Naval Powder Factory
Indian Head, Maryland
Attn: Technical Library

DISTRIBUTION (Cont'd)

1 - Commander
U.S. Naval Proving Ground
Dahlgren, Virginia
Attn: Technical Library

1 - Commanding Officer
Diamond Ordnance Fuze
Laboratories
Washington 25, D. C.
Attn: Technical Reference
Branch

10 - Armed Services Technical
Information Agency
Arlington Hall Station
Arlington 12, Virginia
Attn: TIPDR

1 - Commanding Officer
Raritan Arsenal
Metuchen, New Jersey
Attn: ORDBG-OML

4 - Solid Propellant Information
Agency
Applied Physics Laboratory
The Johns Hopkins University
8621 Georgia Ave.
Silver Spring, Maryland
Attn: K. G. Britton

1 - Sandia Corporation
Sandia Base, New Mexico
Attn: Division 1463,
F. Stein

AD- ACCESSION NO.
R-1605

FRANKFORD ARSENAL, Research and Development Group, Philadelphia 37, Pa.

EVALUATION OF M52A3B1 PRIMER WITH A MODIFIED PRIMING MIXTURE, by F. Lombardi UNCLASSIFIED

Report R-1605, Sep 61; 44 pages incl tables and figures. DA Project 5S0405029; OMS Code 4110.16.0077.1.00.53

Since the FAT27E1 electric primer (developed by Frankford Arsenal) and the Lake City experimental primer (a modified M52A3B1 primer) were developed for use with 20 mm aircraft ammunition, a test program was initiated to determine which would be best suited for general use.

The FAT27E1 primer produced a smaller change in pressure, velocity, and action time over the temperature range -70° to $+165^{\circ}$ F than either the Lake City experimental or the M52A3B1 primers with IMR 7005 and CR 7695 propellants. When used with the IMR 7005 propellant, the FAT27E1 produced excessive pressures at -70° F.

The Lake City experimental and the M52A3B1 primers performed equally well with all three (Cont'd)

UNCLASSIFIED

1. Primer, Electric
2. Propellant
3. Ammuniton, 20 mm, aircraft

I. Lombardi, F.

DISTRIBUTION LIMITATIONS: None; obtain copies from ASTIA.

UNCLASSIFIED

AD- ACCESSION NO.
R-1605

FRANKFORD ARSENAL, Research and Development Group, Philadelphia 37, Pa.

EVALUATION OF M52A3B1 PRIMER WITH A MODIFIED PRIMING MIXTURE, by F. Lombardi UNCLASSIFIED

Report R-1605, Sep 61; 44 pages incl tables and figures. DA Project 5S0405029; OMS Code 4110.16.0077.1.00.53

Since the FAT27E1 electric primer (developed by Frankford Arsenal) and the Lake City experimental primer (a modified M52A3B1 primer) were developed for use with 20 mm aircraft ammunition, a test program was initiated to determine which would be best suited for general use.

The FAT27E1 primer produced a smaller change in pressure, velocity, and action time over the temperature range -70° to $+165^{\circ}$ F than either the Lake City experimental or the M52A3B1 primers with IMR 7005 and CR 7695 propellants. When used with the IMR 7005 propellant, the FAT27E1 produced excessive pressures at -70° F.

The Lake City experimental and the M52A3B1 primers performed equally well with all three (Cont'd)

UNCLASSIFIED

1. Primer, Electric
2. Propellant
3. Ammuniton, 20 mm, aircraft

I. Lombardi, F.

DISTRIBUTION LIMITATIONS: None; obtain copies from ASTIA.

UNCLASSIFIED

AD- ACCESSION NO.
R-1605

FRANKFORD ARSENAL, Research and Development Group, Philadelphia 37, Pa.

EVALUATION OF M52A3B1 PRIMER WITH A MODIFIED PRIMING MIXTURE, by F. Lombardi UNCLASSIFIED

Report R-1605, Sep 61; 44 pages incl tables and figures. DA Project 5S0405029; OMS Code 4110.16.0077.1.00.53

Since the FAT27E1 electric primer (developed by Frankford Arsenal) and the Lake City experimental primer (a modified M52A3B1 primer) were developed for use with 20 mm aircraft ammunition, a test program was initiated to determine which would be best suited for general use.

The FAT27E1 primer produced a smaller change in pressure, velocity, and action time over the temperature range -70° to $+165^{\circ}$ F than either the Lake City experimental or the M52A3B1 primers with IMR 7005 and CR 7695 propellants. When used with the IMR 7005 propellant, the FAT27E1 produced excessive pressures at -70° F.

The Lake City experimental and the M52A3B1 primers performed equally well with all three (Cont'd)

UNCLASSIFIED

1. Primer, Electric
2. Propellant
3. Ammuniton, 20 mm, aircraft

I. Lombardi, F.

DISTRIBUTION LIMITATIONS: None; obtain copies from ASTIA.

UNCLASSIFIED

AD- ACCESSION NO.
R-1605

FRANKFORD ARSENAL, Research and Development Group, Philadelphia 37, Pa.

EVALUATION OF M52A3B1 PRIMER WITH A MODIFIED PRIMING MIXTURE, by F. Lombardi UNCLASSIFIED

Report R-1605, Sep 61; 44 pages incl tables and figures. DA Project 5S0405029; OMS Code 4110.16.0077.1.00.53

Since the FAT27E1 electric primer (developed by Frankford Arsenal) and the Lake City experimental primer (a modified M52A3B1 primer) were developed for use with 20 mm aircraft ammunition, a test program was initiated to determine which would be best suited for general use.

The FAT27E1 primer produced a smaller change in pressure, velocity, and action time over the temperature range -70° to $+165^{\circ}$ F than either the Lake City experimental or the M52A3B1 primers with IMR 7005 and CR 7695 propellants. When used with the IMR 7005 propellant, the FAT27E1 produced excessive pressures at -70° F.

The Lake City experimental and the M52A3B1 primers performed equally well with all three (Cont'd)

UNCLASSIFIED

1. Primer, Electric
2. Propellant
3. Ammuniton, 20 mm, aircraft

I. Lombardi, F.

DISTRIBUTION LIMITATIONS: None; obtain copies from ASTIA.

UNCLASSIFIED

AD- ACCESSION NO.

R-1605 (Cont'd)
propellants, but the Lake City experimental primer produced extreme amounts of flash and smoke at both breech and muzzle when fired in the M39A2 machine gun.

There is no significant advantage in performance with either the FAT27E1 or the Lake City experimental primer over the standard M52A3B1 primer when used with the WC 870 propellant.

UNCLASSIFIED

UNCLASSIFIED

AD- ACCESSION NO.

R-1605 (Cont'd)
propellants, but the Lake City experimental primer produced extreme amounts of flash and smoke at both breech and muzzle when fired in the M39A2 machine gun.

There is no significant advantage in performance with either the FAT27E1 or the Lake City experimental primer over the standard M52A3B1 primer when used with the WC 870 propellant.

UNCLASSIFIED

UNCLASSIFIED

AD- ACCESSION NO.

R-1605 (Cont'd)
propellants, but the Lake City experimental primer produced extreme amounts of flash and smoke at both breech and muzzle when fired in the M39A2 machine gun.

There is no significant advantage in performance with either the FAT27E1 or the Lake City experimental primer over the standard M52A3B1 primer when used with the WC 870 propellant.

UNCLASSIFIED

UNCLASSIFIED

AD- ACCESSION NO.
R-1605

UNCLASSIFIED

FRANKFORD ARSENAL, Research and Development Group, Philadelphia 37, Pa.

EVALUATION OF M52A3B1 PRIMER WITH A MODIFIED PRIMING MIXTURE, by F. Lombardi UNCLASSIFIED

Report R-1605, Sep 61; 44 pages incl tables and figures. DA Project 5S0405029; OMS Code 4110.16.0077.1.00.53

Since the FAT27E1 electric primer (developed by Frankford Arsenal) and the Lake City experimental primer (a modified M52A3B1 primer) were developed for use with 20 mm aircraft ammunition, a test program was initiated to determine which would be best suited for general use.

The FAT27E1 primer produced a smaller change in pressure, velocity, and action time over the temperature range -70° to +165° F than either the Lake City experimental or the M52A3B1 primers with IMR 7005 and CR 7695 propellants. When used with the IMR 7005 propellant, the FAT27E1 produced excessive pressures at -70° F.

The Lake City experimental and the M52A3B1 primers performed equally well with all three (Cont'd)

1. Primer, Electric
2. Propellant
3. Ammuniton, 20 mm, aircraft

I. Lombardi, F.

DISTRIBUTION LIMITATIONS: None; obtain copies from ASTIA.

UNCLASSIFIED

AD- ACCESSION NO.
R-1605

UNCLASSIFIED

FRANKFORD ARSENAL, Research and Development Group, Philadelphia 37, Pa.

EVALUATION OF M52A3B1 PRIMER WITH A MODIFIED PRIMING MIXTURE, by F. Lombardi UNCLASSIFIED

Report R-1605, Sep 61; 44 pages incl tables and figures. DA Project 5S0405029; OMS Code 4110.16.0077.1.00.53

Since the FAT27E1 electric primer (developed by Frankford Arsenal) and the Lake City experimental primer (a modified M52A3B1 primer) were developed for use with 20 mm aircraft ammunition, a test program was initiated to determine which would be best suited for general use.

The FAT27E1 primer produced a smaller change in pressure, velocity, and action time over the temperature range -70° to +165° F than either the Lake City experimental or the M52A3B1 primers with IMR 7005 and CR 7695 propellants. When used with the IMR 7005 propellant, the FAT27E1 produced excessive pressures at -70° F.

The Lake City experimental and the M52A3B1 primers performed equally well with all three (Cont'd)

1. Primer, Electric
2. Propellant
3. Ammuniton, 20 mm, aircraft

I. Lombardi, F.

DISTRIBUTION LIMITATIONS: None; obtain copies from ASTIA.

UNCLASSIFIED

AD- ACCESSION NO.
R-1605

UNCLASSIFIED

FRANKFORD ARSENAL, Research and Development Group, Philadelphia 37, Pa.

EVALUATION OF M52A3B1 PRIMER WITH A MODIFIED PRIMING MIXTURE, by F. Lombardi UNCLASSIFIED

Report R-1605, Sep 61; 44 pages incl tables and figures. DA Project 5S0405029; OMS Code 4110.16.0077.1.00.53

Since the FAT27E1 electric primer (developed by Frankford Arsenal) and the Lake City experimental primer (a modified M52A3B1 primer) were developed for use with 20 mm aircraft ammunition, a test program was initiated to determine which would be best suited for general use.

The FAT27E1 primer produced a smaller change in pressure, velocity, and action time over the temperature range -70° to +165° F than either the Lake City experimental or the M52A3B1 primers with IMR 7005 and CR 7695 propellants. When used with the IMR 7005 propellant, the FAT27E1 produced excessive pressures at -70° F.

The Lake City experimental and the M52A3B1 primers performed equally well with all three (Cont'd)

1. Primer, Electric
2. Propellant
3. Ammuniton, 20 mm, aircraft

I. Lombardi, F.

DISTRIBUTION LIMITATIONS: None; obtain copies from ASTIA.

UNCLASSIFIED

AD- ACCESSION NO.
R-1605

UNCLASSIFIED

FRANKFORD ARSENAL, Research and Development Group, Philadelphia 37, Pa.

EVALUATION OF M52A3B1 PRIMER WITH A MODIFIED PRIMING MIXTURE, by F. Lombardi UNCLASSIFIED

Report R-1605, Sep 61; 44 pages incl tables and figures. DA Project 5S0405029; OMS Code 4110.16.0077.1.00.53

Since the FAT27E1 electric primer (developed by Frankford Arsenal) and the Lake City experimental primer (a modified M52A3B1 primer) were developed for use with 20 mm aircraft ammunition, a test program was initiated to determine which would be best suited for general use.

The FAT27E1 primer produced a smaller change in pressure, velocity, and action time over the temperature range -70° to +165° F than either the Lake City experimental or the M52A3B1 primers with IMR 7005 and CR 7695 propellants. When used with the IMR 7005 propellant, the FAT27E1 produced excessive pressures at -70° F.

The Lake City experimental and the M52A3B1 primers performed equally well with all three (Cont'd)

1. Primer, Electric
2. Propellant
3. Ammuniton, 20 mm, aircraft

I. Lombardi, F.

DISTRIBUTION LIMITATIONS: None; obtain copies from ASTIA.

UNCLASSIFIED

AD- ACCESSION NO.

R-1605 (Cont'd)
propellants, but the Lake City experimental primer produced extreme amounts of flash and smoke at both breech and muzzle when fired in the M39A2 machine gun.

There is no significant advantage in performance with either the FAT27E1 or the Lake City experimental primer over the standard M52A3B1 primer when used with the WC 870 propellant.

UNCLASSIFIED

UNCLASSIFIED

AD- ACCESSION NO.

R-1605 (Cont'd)
propellants, but the Lake City experimental primer produced extreme amounts of flash and smoke at both breech and muzzle when fired in the M39A2 machine gun.

There is no significant advantage in performance with either the FAT27E1 or the Lake City experimental primer over the standard M52A3B1 primer when used with the WC 870 propellant.

UNCLASSIFIED

UNCLASSIFIED

AD- ACCESSION NO.

R-1605 (Cont'd)
propellants, but the Lake City experimental primer produced extreme amounts of flash and smoke at both breech and muzzle when fired in the M39A2 machine gun.

There is no significant advantage in performance with either the FAT27E1 or the Lake City experimental primer over the standard M52A3B1 primer when used with the WC 870 propellant.

UNCLASSIFIED

UNCLASSIFIED

AD- ACCESSION NO.

R-1605 (Cont'd)
propellants, but the Lake City experimental primer produced extreme amounts of flash and smoke at both breech and muzzle when fired in the M39A2 machine gun.

There is no significant advantage in performance with either the FAT27E1 or the Lake City experimental primer over the standard M52A3B1 primer when used with the WC 870 propellant.

UNCLASSIFIED

UNCLASSIFIED